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AGRICULTURAL RESEARCH INSTITUTE

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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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PREFACE

This Index though arranged alphabetically retains the grouping of the subjects used in the *International Review.*

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *Review.*

The Index consists of three parts: one of the original articles, one concerned with Agricultural Intelligence and the last with Plant Diseases.

In case of errors in the *Review* with reference to scientific terms. and the names of authors, it should be noted that the correct spelling can be relied upon in the Index.

The Table used for the conversion of the Weights, Measures and Money values of the various countries to the Metric System is included.

This Index was prepared by rédacteurs: Dr. Giulio Provenzal and Prof. Giulio Trinchieri, the latter compiled the Index of Plant Diseases. The whole was adapted to the English Edition by rédactrice Miss M. L. Yeo.

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IV. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia) = 27.99961 inches
1 Ardeb (Egypt) = 5.44435 bushels
1 Ardeb of wheat (Egypt) = 2.95264 cwt.
1 Ardeb of hulled maize (Egypt) = 2.75580 cwt.
1 Ardeb of barley (Egypt) = 2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt) = 5.72812 cwt.
1 Ardeb of decorticated rice (Egypt) = 3.83813 cwt.
1 Arpent (Canada) = 0.84501 acres
1 Are [100 square metres] = 107.63915 square feet
1 Arroba (Brazil) = 33.06951 lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru) = 25.35841 lbs.
1 Arroba (Mexico) = 25.36687 lbs.
1 Bale of cotton (Brazil) = 396.83415 lbs.
1 Bale of cotton (United States) = 4.46431 cwt. (gross wt.)
1 » » » » » = 4.26788 cwt (net wt.
1 Bale of cotton (India) = 3.57145 cwt.
1 Barrel of wheat flour (Canada, United States) = 1.75001 cwt.
1 Bar, see Millier ———
1 Bow (Java, Dutch Indies) = 76.36998 square feet
1 Bushel (United States) = 0.96896 bushels
1 Bushel of oats (United States) = 32 lbs.
1 Bushel of oats (Canada) = 34 lbs.
1 Bushel of wheat and potatoes (United States) = 60 lbs.
1 Bushel of barley (Canada, United States) = 48 lbs.
1 Bushel of raw rice (United States) = 45 lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States) = 56 lbs.
1 Cadastral arpent (Hungary) = 1.42201 acres
1 Cental (United States) = 100 lbs.
1 Centiare [10 square metres] = 10.76392 square feet
1 Centigramme = 0.15432 grains
1 Centilitre = 0.0022 gallons
1 Centimetre = 0.393715 inches
1 Centistere = 0.35315 cubic feet
1 Centner (Germany, Austria, Denmark) = 110.23171 lbs
1 Centner (Sweden) = 93.71238 lbs.
1 Cho [60 ken] (Japan) = 119.30327 yards
1 Cho (Japan) = 2.45068 acres
1 Crown [100 heller] (Austria-Hungary) = 10 *d* at par
1 Crown [100 öre] (Denmark, Norway, Sweden) = 1*s* 1 1/3 *d* at par
1 Cubic centimetre = 0.06102 cubic inches
1 Cubic metre = 1.30795 cubic yards
1 Decagramme [10 grammes] = 0.35275 oz.

1 Decalitre [10 litres]	= 2.19976 gallons
1 Decametre [10 metres]	= 32.80840 feet
1 Decare [1000 square metres]	= 1195.98627 square yards
1 Decastere [10 cubic metres]	= 13.07951 cubic yards
1 Deciare [10 square metres]	= 11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	= 2.69966 acres
1 Decigramme	= 1.54323 grains
1 Decilitre	= 0.022 gallons = 0.0027497 bushels
1 Decimetre	= 3.93701 inches
1 Decistere	= 3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	= $9\,{}^{33}/_{64}\,d$ at par
1 Dollar, gold, $ [100 cents] (United States)	= $4\,s\ 1\,{}^{5}/_{16}\,d$ at par
1 Drachm, gold [100 lepta] (Greece)	= $9\,{}^{33}/_{64}\,d$ at par
1 Dz. = Doppelzentner (Germany)	= 220.46341 lbs.
1 Egyptian kantar (Egypt)	= 99 04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	= 1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	= $1\,s\ 7\,{}^{53}/_{64}\,d$ at par
1 Franc [100 centimes] (France)	= $9\,{}^{33}/_{64}\,d$ at par
1 Gallon (United States)	= 0.83270 gallons
1 gramme	= 0.03527 oz.
1 Hectare [10 000 square metres]	= 2.47109 acres
1 Hectogramme (100. grammes)	= 3.52746 oz.
1 Hectolitre [100 litres]	= 21.99755 gallons = 2.74967 bushels
1 Hectometre [100 metres]	= 109.36133 yards
1 Hectostere [100 cubic metres]	= 130.79505 cubic yards
1 Jarra (Mexico)	= 7.22642 quarts
1 Kadastral hold, see Cadastral arpent	—
1 Kin (Japan)	= 1.32278 lbs.
1 Kokou [10 to] (Japan)	= 1.58726 quarts
1 Kokou of oats (Japan)	= 1.55014 cwt.
1 Kokou of cocoons (Japan)	= 82.67268 lbs.
1 Kokou of wheat and maize (Japan)	= 2.58356 cwt.
1 Kokou of barley (Japan)	= 2.06685 cwt.
1 Kokou of naked barley (Japan)	= 2.69428 cwt.
1 Kokou of rice (Japan)	= 2.80501 cwt.
1 Kopek (Russia)	= $1\,{}^{2}/_{200}$ farthing at par
1 Kwan (Japan)	= 8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	= $9\,{}^{33}/_{64}\,d$ at par
1 Leu [100 statinki] (Bulgaria)	= $9\,{}^{33}/_{64}\,d$ at par
1 Lira [100 centesimi] (Italy)	= $9\,{}^{33}/_{64}\,d$ at par
1 Litre	= 0.21998 gallons = 0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	= 1.72665 acres
1 Mark [100 Pfennige] (Germany)	= $11\,{}^{3}/_{4}\,d$ at par
1 Mark [100 penni] (Finland)	= $9\,{}^{33}/_{64}\,d$ at par

1 Maund Factory (India) = 74.6709 lbs.
1 Maund Imperial (India) = 82.28136 lbs.
1 Metre = 3.28084 feet
1 Milliare = 1.07639 square feet
1 Milligramme = 0.01543 grains
1 Millilitre = 0.00022 gallons
1 Millimetre = 0.03937 inches
1 Millistere = 61.02361 cubic inches
1 Myriagramme [10 000 grammes] = 22.04634 lbs.
1 Myrialitre [10 000 litres] = 2 199.75539 gallons
= 274.96701 bushels
1 Myriametre [10 000 metres] = 6.21373 miles
1 Millier [1 000 000 grammes] = 19.68426 cwt.
1 Milreis, gold (Brazil) = 2*s* 2 $^{61}/_{64}$ *d* at par
1 Milreis, gold (Portugal) = 4*s* 5 $^{19}/_{64}$ *d* at par
1 Minot (Canada) = 1.07306 bushels
1 Morgen (Cape of good Hope) = 2.11654 acres
1 Muid (Cape of good Hope) = 24 gallons
= 3 bushels
1 Oka (Greece) = 2.75579 lbs.
1 Oke (Egypt) = 2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain) = 9 $^{33}/_{64}$ *d* at par
1 Peso, gold [100 centavos] (Argentina) = 3*s* 11 $^{37}/_{64}$ *d* at par
1 Peso, gold [100 centavos] (Chili) = 1*s* 5 $^{63}/_{64}$ *d* at par
1 Pic (Egypt) = 2.46646 feet
1 Pikul (China) = 133.27675 lbs.
1 Pikul (Japan) = 132.27805 lbs
1 Poud (Russia) = 36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres] = £1 0. 6 $^{43}/_{64}$ at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire) = 18 *s* 0 $^{51}/_{64}$ *d* at par
1 Pund (Sweden) = 0.93712 lbs
1 Quintal = 1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia) = 2*s* 1 $^{3}/_{8}$ *d* at par
1 Rupee, silver [16 annas] (British India) = 1*s* 4 *d* at par
1 Square metre = 1.19599 square yards
1 Stere [1 cubic metre] = 1.30795 cubic yards
1 Sucre, silver (Ecuador) = 1*s* 11 $^{51}/_{64}$ *d* at par
1 Talari [20 piastres] (Egypt = 4*s* 1 $^{11}/_{64}$ *d* at par
1 To (Japan) 0.49601 bushels
= 3.96815 gallons
1 Ton (metric) = 0.98421 tons
1 Verst (Russia) = 1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan) = 2*s* 0 $^{37}/_{64}$ *d* at par
1 Zentner (Germany) = 110.23171 lbs.

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BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

1 – **Agriculture in Persia (Persian Products, Rich and Varied Resources).** — *The Times Trade Supplement*, Vol V, No 70, p 135 London, 1920

Agriculture is by far the most important of the Persian industries, in spite of which the demand for agricultural products largely exceeds the supply With the advent of railways, exports as well as imports will come into far greater prominence than hitherto, but it is difficult to see how agriculture can benefit to any appreciable extent unless the present irrigation systems are revolutionised

The soil of the country is decidedly suitable for the many and varied crops grown When water is available two or even three crops can be raised annually Fruit and other trees when planted under suitable conditions are prolific in growth Wheat, barley, rice, opium, cotton, tobacco, lucerne, clover, peas, beans, and various root crops, including sugar beet, all yield an abundant harvest. Various oil-producing plants such as linseed and castor oil, do equally well. A large quantity of Persian wheat finds its way into the English market, and possessing as it does special qualities, it is most valuable for mixing with British and other wheats ; it is not surprising, therefore, that the demand for this cereal is greater than the supply. Tobacco is grown extensively in the Ispahan and Shiraz districts, a large part of which is bought up by Levantine merchants.

Hitherto the Persian cotton crop has almost entirely been absorbed by Russia. There is much room for experiment and development in the cultivation of cotton, especially with a view to growing the most suitable varieties for the English market.

Persian opium is much sought after in the London sale rooms, because of the large percentage of opium content, and can easily compete with that grown in any other part of the world.

There are great possibilities in the cultivation of sugar beet. Persia at present relies entirely on the outside world for its sugar supply; the consumption per head works out at a very high average. With very little enterprise, sugar could be manufactured on the spot, and a sugar factory would prove to be really paying concern.

Vegetable oils are not exported to any great extent, but there is no reason why this industry should not be developed, especially in view of the increasing demand for vegetable oils.

The climate of the Persian highlands is in every way suitable for fruit cultivation. Apricots, peaches, nectarines, pears, grapes, plums, cherries, figs, and almonds all grow to perfection. The Ispahan melon has been judged by an American horticultural expert to be the finest in the world. This special melon can be stored for at least six months, but so far has not been exported. Canned and dried fruits, fruit pulp, and jam could be exported on a large scale if once these industries were seriously taken in hand.

The two essential things necessary for the development of Persian industries are improved communications and the establishment of various irrigation systems. So confident are many Persian financiers and landowners as to the success of a scheme for irrigating the Ispahan plain that with little inducement they would provide half the necessary capital. The many thousands of acres that are not under cultivation owing to water shortage could be leased at a very moderate sum or bought outright from the Persian Government. Local farmers when once assured of a good water supply would readily pay the rental and water dues demanded. There is little doubt that such an undertaking, once launched, would prove a great success.

2 - **Nutritive Value of the Proteins of Barley, Oat, Rye and Wheat Kernels.** — OSBORNE, T. B., MENDEL, B , and WAKEMAN, A. S (Laboratory of the Connecticut Agricultural Experiment Station and the Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XLI, No. 3, pp. 275-306, tables 5, charts 13 Baltimore, March, 1920.

The deficiency in certain of the essential dietary components, notably specific inorganic elements and fat-soluble vitamine has led to the general conviction of investigators that none of the common cereal grains alone or even a mixture of them, suffices to afford satisfactory nutrition. The foremost remaining dietary factor in these seeds is protein and the writers consider that the misconception of the possible value of cereals as sources of protein is due to lack of realisation that in the form in which these grains are most commonly fed, the sum total of their various proteins must be taken into account.

Investigations were resumed with white rats in attempting a further study of the relative nutritive value of the cereal proteins (1) by feeding with entire cereal grains, finely ground, together with an adequate 3 % salt mixture and 5 % butter fat to supply the fat soluble vitamine, on the assumption that these grains would supply sufficient water soluble vitamine. Where necessary, enough maize starch was added to make the total protein of the ration 5.8 or 10 % approximately. In this way the proteins of barley, oats, rye and wheat were compared.

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(1) See *R.* Oct, Dec 1919, No. 1175.

[1-2]

Barley. — The experiments leave no doubt as to the adequacy of barley proteins as a whole, for the nutrition. From the evidence secured by STEENBOCK, KENT and GROSS (1) regarding the content of water soluble vitamine in barley, the lack of the latter may be considered the cause of poorer growth in the authors' experiments with diets containing only 5 % barley protein. The rats on the 5 % protein diets ate as much total food i. e. calories, as those of the same size on higher concentrations. New experiments furnishing a ration low in protein but adequate in water soluble vitamine were carried out. The diet was the same as in the earlier series but with the addition of approximately 18.6 mg. daily, apart from the food of a protein free vitamine preparation from yeast. The food intakes showed no noteworthy increase, nor was the gain per gm. of protein eaten, more favourable; hence the slow growth on the 5 % ration can still be ascribed to the comparatively small quantity of protein afforded by diet.

Experiments were carried out on similar lines with oats (1), rye, and wheat and charts illustrate the comparative nutritive efficiency of these kernels. The comparative equality of the four types of cereal proteins becomes more stiking when the gains which they promote per gram of protein consumed are contrasted with those secured within comparable periods of growth by the use of proteins from other sources. The advantage of more efficient supplementary protein to the cereal protein has previously been discussed (2). The utilisation data secured by the authors, testifies to the unexpected availability for growth of the proteins of these whole cereals, and is in harmony with the work of SHERMAN and collaborators (3) connected with the maintenance metabolism of adults as shown by nitrogen balance experiments on diets in which the proteins of oats and maize contributed a large portion of the protein intake. These results showed that for purposes of practical dietetics equal weights of oat and maize proteins may be regarded as essentially equal in value, and even the minimum amount of milk which can possibly be regarded as permissible in the light of the present knowledge of nutrition will apparently so supplement the protein of either the maize or oat kernel as to make them function with an efficiency comparable with that of the average protein of mixed diet in the maintenance metabolism of man.

The authors note that the sufficient, successful prolonged growth observed in the case of all the cereal studies, makes it unlikely that the protein factor is responsible for the untoward outcome of many of the cereal experiments undertaken hitherto.

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(1) See *R.* Dec. 1919, No. 1379.

(2) See *R.* June 1917, No. 568.

(3) See *J. Biol. Chem.* 1918, Vol. XXXIV, p. 383. (*Ed.*)

3 - **The Antiscorbutic Property of Vegetables. An Experimental Study of Raw and Dried Potatoes.** — GIVENS, M. H and MC CLUGAGE, H. B. (Department of Physiology, University of Rochester), in *The Journal of Biological Chemistry*, Vol. XLII, No. 3, pp 491-515, table I, Charts XVII, bibliogr. of 13 works, Baltimore, July, 1920.

Reports have already been published that under certain conditions, cabbage (1), tomatoes (2) and orange juice can be dehydrated so that the resultant dried products retain a significant amount of the antiscurvy vitamine. The authors continued their studies on similar lines in order to ascertain whether the antiscorbutic vitamine in potatoes is destroyed at definite temperatures during drying quite apart from the value of the nitrogen-containing compounds (3) and the content of inorganic salts and water and fat-soluble vitamines (*Journal of Biological Chemistry.*, Vol. XXXVI, p. 197, 1918) previously under investigation elsewhere.

The experimental animals were healthy young guinea pigs. The basal diet used to produce scurvy was made of heated soya bean flour, milk, yeast, paper pulp, calcium lactate and sodium chloride. The daily allotment of undried samples was 10 gm., per animal and of dried and cooked potatoes, 2.5 gm. On this basis every animal received approximately the same amount of total solids of potatoes equivalent to that contained in 10 gm., of the raw material. The different ranges of temperature for drying were 35 to 40°, 55 to 60°, and baking at 204° and then drying at 35 to 40°C.

A review of the appended charts shows the results with differently treated potatoes considered as antiscorbutic supplements to the basal soya cake diet. A temperature of 35 to 40°C for 6 to 8 hours was apparently more destructive than 55 to 60° for 4 to 6 hours, and the latter was hardly as destructive as 75 to 80°C for 2 to 3 hours. This conclusion was based on the results obtained with potatoes dried at those temperatures and fed uncooked and cooked for 15 minutes at 100°C. With 2.5 gm, dried at 35 to 40°C and fed without further treatment, death from scurvy was slightly delayed; with 5 gm., life was certainly prolonged. If the dried products were further heated in water at 100°C for 15 minutes and then fed in amounts equivalent to 2.5 gm., of dried material, there was no evident protection with the 35 to 40° and 75 to 80°C products, but there was certainly some with the 55 to 60°C material, potatoes baked and then dried gave a product which possessed antiscorbutic potency.

From these results it is assumed that the factors involved in the destruction of the antiscorbutic vitamine include not only the degree of heat and the duration of heating, but also the enzyme content and the reaction of the food being dried. The authors assume also that at any temperature below 80°C, the enzymes are functionating. All potatoes dehydrated below this temperature darkened during the dessication.

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(1) See *R.* Oct.-Dec. 1919, No. 1071.

(2) See *R.* Jan. 1920, No 5.

(3) See *R.* April 1918, No. 378.

[2-3]

The minimum amount of raw potatoes which will protect a guinea pig against scurvy has not been determined but the feeding curve indicates that slightly less than 10 gm., per day was about the lowest limit to suffice for protection.

As a result of former experiments with pigeons and with rats (GIVENS and COHEN), the experimental diet employed apparently contained among its satisfactory components the fat-soluble and water soluble vitamines. But the effect on guinea pigs and the necessary addition of a new vitamine to prevent spread of scurvy, conformed the belief that there is an antiscorbutic vitamine. OSBORNE and MENDEL (1) found that 0.2 gm., of dried brewers' yeast per rat per day was sufficient to promote normal growth. The basal diet used for producing scurvy contained more than twice that amount. There is no base to warrant the allegation that the drying of the basal diet or potatoes destroyed either the fat or water soluble vitamine.

The results with fresh potatoes cooked and those dried at 35 to 40°C and then cooked, confirm those of former investigation, (HOLST and FRÖLICH, *Zoological Hygiene*, Vol. LXXII, p. 1, 1912 and CHICK and HUME, *The Lancet* Vol. II, p. 774, 1918).

4 - **Some Nutritive Properties of Nuts; their Proteins and Content of Water-Soluble Vitamine.** — CAJORI, F. A. (Sheffield Laboratory of Physiological Chemistry. Yale University), in *The Journal of Biological Chemistry*, Vol. XLIII, No. 2 pp. 583-606, tables 3, charts 8, bibliogr of 31 works, Baltimore, M. D., September, 1920.

The conclusion, based on chemical analysis, that nut proteins are of high biological value. has been verified by the experiments of JOHNS, FINKS and GERSDORFF with the coconut (2) and DANIELS and LOUGHLIN with the peanut (3). These investigators observed normal growth in young rats on diets in which the coconut and peanut furnished the sole source of protein. The author extended feeding observations on nuts to include the almond, English walnut, filbert, pecan and pine nut. Young rats were fed on diets complete in respect to every dietary essential for growth, provided the proteins were of a character to support growth. Nut proteins made up approximately 18 % of the diets.

Examination of the growth curves shows that the growth resulted at a normal rate on all diets except when 'pecan supplied the protein. The animals on this diet grew at a rate of about two thirds normal during the nine weeks test. When one-third of the pecan protein was replaced by casein, a marked rise in the rate of growth was noted. More experiments are necessary before final conclusions can be drawn regarding the comparative efficiency of the pecan proteins. The author states that by accepting the opinion of OSBORNE and MENDEL (3), it may be concluded from the results of these experiments, that the almond, English walnut, filbert and pine nut are sources of protein adequate for nutrition. These were also found to furnish the necessary nitrogen complexes for the elaboration of milk in rats. The approximate quantitative idea of the comparative distribution of water soluble vitamine amongst these plant products was obtained.

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(1) See *R.* Feb. 1920, No. 157.

(2) See *R.* April, 1919, No. 439.

(3) See *R.* July, 1918, No 785.

A daily dose of 2 gm., of hickory nut, pine nut and pecan, respectively, or the inclusion of 27 % of almond, or filbert and 19 % english walnut in the food was found sufficient to enable animals that had declined on the basal diet, namely ; Casein, butter fat, inorganic salts, starch and lard, and with an obvious lack of water. soluble vitamine, to recover rapidly and resume growth. 1 gm. of English walnut, black walnut, hickory nut or pine nut proved to be an equally efficient restorative agent. The chestnut, English walnut and pecan appeared to be especially potent, daily doses of 0.5 gm., sufficing to permit slow growth. A comparison of the growth curves indicates that the almond was not so efficacious as a source of water soluble vitamine.

5 - Agricultural Instruction in the Former Austro-Hungarian Empire during the War (1). — Communication by M. H. Kallbrunner, *Austrian correspondent of the International Institute Agriculture.*

During the war very little was done in all the belligerent countries that had not a direct bearing on the issue at stake. It is true that, as shown in the appended data, the number of schools had increased, but a good number had to be closed, partly because the teachers and elder pupils had been called to the colours, partly because some schools were situated in the war zone, and partly because owing to the scarcity of labour, parents were obliged to keep their children to work at home. The schools that were still kept open were so poorly attended that instruction was necessarily suspended.

The data shown in the appended table are taken from the *Land und Forstwirtschaftliche Unterrichtszeitung*, Parts I e II, Vienna 1918.

The following are a few notes on the Table: —

The " Hochschulen " only accept pupils who have taken their secondary school classical (" Gymnasium ") or technical (" Realschule ") diploma. These schools are situated at: (1) Vienna, where there is a section for forestry and cultural technique branches ; (2) Prague where it is affiliated to the University ; (3) Cracow, affiiliated to the " Technische Hochschule. " All these institutions, during the war, had exceptionally few pupils, as these were just of the age for military service.

The higher Agricultural College (" Hochschule für Boden Kultur ") at Vienna held courses during the war for refugees from the war zone, disabled men and those unfit for service. The number of students at the school was 464 in March, 1918, and after the Armistice the number rose to over 2000 but soon felt to 1200 which was fortunate, as the school could not accomodate such large numbers. After the partition of the Empire new

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(1) For further information see *R.* Oct. 1913, pp. 1521-1538, " State of Agricultural Education in Austria. " Ernest Vital. (*Ed*)

TABLE I. — *The Development of the Agricultural Colleges in the late Austro-Hungarian Empire.*

Class	Establishments dependant on					Total	Affiliated to a College	Number of teaching Staff		Number of Students		Diplomas received the preceeding year	Diploma Students in preceding year		Salaries	
	The State	The Province	Department as Commune	Societies	Private persons			Permanent	Temporary	Total	Farmer's and Forester's Sons		Managing Parent's Farm	Engaged in Agriculture or Sylviculture	As Masters	Total salaries in kröner
High Schools	3	—	—	—	—	3	—	56	97	834	233	42	?	?	47	25 100
Academies	—	3	—	1	—	4	1	37	47	267	139	15	3	9	18	3 000
Middle Schools	1	11	—	4	1	17	7	136	77	1 563	864	183	84	88	103	37 506
Girls' Agricultural Schools	—	1	—	1	1	3	3	21	22	112	22	38	13	25	1	1 200
Lower Agricultural Schools	5	113	21	58	13	210	128	590	637	4 744	3 745	2 294	1 630	370	581	96 852
Totals in March, 1918	**9**	**128**	**21**	**64**	**15**	**237**	**139**	**840**	**880**	**7 550**	**5 003**	**2 572**	**1 730**	**492**	**750**	**163 728**
Totals in March, 1917	9	125	21	64	15	234	136	844	842	5 443	3 745	2 252	1 354	439	737	162 485
» » » 1916	9	123	21	66	15	234	134	836	841	4 894	3 366	2 457	1 527	450	804	181 674
» » » 1915	9	121	21	65	14	230	123	828	830	4 761	3 308	4 662	2 895	1 023	1 658	246 830
» » » 1914	9	119	19	68	14	229	140	910	1 281	10 835	7 795	5 202	3 406	1 248	2 346	385 610
» » « 1913	9	118	19	66	14	226	132	952	1 202	10 491	7 429	5 109	3 263	1 233	2 123	413 835
» » » 1912	9	112	18	69	13	221	131	921	1 114	10 587	7 260	4 866	3 035	1 162	2 029	418 116
» » » 1911	9	121	18	70	11	219	121	798	1 128	10 096	6 937	4 886	2 968	1 240	2 037	378 493
» » » 1910	9	75	17	103	10	214	122	763	1 052	9 834	6 838	4 608	2 610	1 209	2 418	391 652
» » » 1909	9	70	17	103	10	206	94	704	961	9 007	6 283	3 848	2 122	1 144	1 976	356 976

Agricultural schools were soon established in the new States at Brünn, in Czecho-Slovakia and at Agram, in Yugoslavia.

The Schools of Arts and Crafts (" höhere Fachschulen ") are known as " Akademien " and give a years instruction to those students who have failed to obtain their secondary school diploma, but have been shown to possess a standard of education corresponding to that necessary in former Austria to obtain the right of one years free instruction. There was one of these Academies at Tabor, where the teaching was in Czech, one at Tetschen-Liebwerd, where the teaching was in German, although the Academy is now in Czeco-Slovakia, and a third is at Dublang where the teaching is given in Polish. Moreover at Vienna there is a Brewing School (" Akademie für Bramindustrie "), but it was closed during the war. At all these institutions there were at that period special courses open for disabled men who were previously engaged in agricultural work and also for those who were unable to follow their former profession and wished to take up a new one. Many of these were under the impression that agriculture could be learned in a few weeks, but they were sadly disillusioned. They were unsuccessful at the practical work and they could either obtain no employment at all or had to content themselves with a very modest employment. Better results were obtained with men who specialised and could make some use of their former experience, the most successful courses being those training men for driving motor-ploughs, all types of steam-engines drainage, etc. Besides these courses special courses have been organised, as in pre-war days, for subjects such as forestry, horticulture, dairying, etc. and agricultural instruction for teachers.

The " Landwirtschaftliche Mittelschulen " admit youths who had attended all 4 classes of an ordinary " middle " school. As the pupils in all four classes were often under military age, the numbers, expecially in the lower classes, were comparatively high. But there were cases where the higher classes had so few pupils that it was decided to suppress or amalgamate them with others. In order to obtain the best possible results in cultivating the fields from those members of the staff who were not on military service, numerous courses were held in these schools, special attention being given to the training of the disabled and courses were arranged on pisciculture, bee keeping, book-keeping, agricultural improvements, arboriculture and gardening, and at the middle forestry schools (" Forstlichen Mittleschalen), on forest protection and exploitation type-writing, etc.

The Middle School of Agriculture Laa-an-der-Taya is worthy of special note, as on account of its high grade of teaching it is aspiring to be nominated as an Academy and seeks particularly to get in touch with agriculture practice (1). During the first 2 years the students do not attend the school very much, but live on a neighbouring farm where they learn the practical side under the supervision of the school which gives them weekly theoretical lectures. All that they have seen is discussed, and by this means the interest of the students is stimulated. The students are also taught how to keep the books. The pupils usually remain for one year on a small farm, then spend a second year on a large farm where they learn how to cope with entirely different conditions.

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(1) See *Programm der höheren landwirtschaftlichen Lehranstalt in Lae a. d. Taya, Niederosterreich Selbstverlag.* (*Ed.*)

But this means the student receives a more thorough instruction than in a school to which a farm is attached, but where the student has no chance of doing practical work and thus learning the work in all its details It is certain that the new methods of instruction will prove successful The author considers it especially advantageous that the young student should learn the practical side of farming in this way before studying its theory, so that he still has time to change his studies if he finds that he is not suited to farming. The pupil at the ordinary schools begins field work at a relatively advanced age and if it does not suit him he can hardly change; being obliged to continue without the taste or aptitude for his profession. An agricultural school for girls was started at Otterbach (Upper Austria) in 1911 and another at Lemberg (Galicia) in 1913. These two schools gave 2 courses. During the war an agricultural school for girls and a " normal " school for teachers of domestic economy, both giving 3 courses were established at Bruck-am-Leitha (1).

The elementary agricultural schools (" niederen Landwirtschaftschulen ") are divided into 2 groups. The first, school for farmers (" Ackerbauschulen "), gives instruction all the year round; the second, winter schools (" Winterschulen ") are usually open from November to the end of March. During the war all these schools suffered, partly owing to shortage of manual labour, and partly owing to the departure of the older pupils for military service. The only method which could be adopted by farmers was to keep their children at home to work. In addition, many of the elementary schools were in the war zone so that all instruction in them was impossible. The schools were kept open only by running numerous short courses, which enabled the children of the peasants to attend. Now they are working normally, the attendance being very large. The grave financial position of the State has seriously affected agricultural instruction, which is relatively, expensive. It can be seen from Table I that the number of grants to assist the children of poor farmers to study is constantly decreasing, which hinders some of the more industrious and intelligent students from continuing their studies. It is just the same with the means of instruction . With regard to this, the decrease in numbers of private schools and those governed by societies, is very noticeable, as they now mostly lack the means to enable them to prosper and they would be glad to become public institutions. This decrease would have been much greater if there had not been some new foundations, especially of small schools which are dependant on societies.

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(1) See " Errichtung einer landwirtschaftlichen Frauenschule in Niederosterreich " in *Land und Forstwissenschaftliche Unterrichtszeitung*, Parts 1-2 1918, Vienna. (*Ed.*)

These difficulties were present before the war, but the lack of coal and the shortage of teachers made matters very much worse, necessitating closure in some cases. These difficulties will be felt still more in the future when competition becomes more acute, if the proper training of technicians is entirely lacking for several years.

Certain organisations and political leaders have demanded that the director of any farm should possess a certain minimum of elementary education, without which no-one should be allowed to farm; thus a farm of a certain size ought to be managed only by a person with a higher Agricultural Diploma or that of a middle school plus a double period of practical work. But most of the high posts are already filled by men not conforming to these standards and these efforts, praiseworthy in many respects, cannot succeed, an additional factor being the shortage of suitable candidates. These projects are opposed, and justly, by those who maintain that instruction in a school is not everything and can often be replaced by practical experience; further if a student desires to obtain technical instruction he will do so without being compelled (1).

By a Government Order issued in 1916 those who have obtained the Higher Diploma of the Agricultural Schools have the right to bear the title of engineer.

Unfortunately, Austria completely lacks agricultural finishing schools ("landwirtschaftliche Fortbildungsschulen"), although these are being demanded on all sides (2). A scheme has also been proposed by which travelling schools would be formed, to visit sufficiently large villages, staying one year at each in such a way that after a certain time the school would return to the same place so that a group of young men would be able to attend again, and the majority of farmers be able to would follow supplementary courses. In Czecho-Slovakia a law has been passed authorising the formation of supplementary schools, but it, is impossible to say yet whether it is practicable.

The most important school for the farmers is the elementary "Volksschule," which should supply a good preliminary education which would fit children for their intended profession, in the best way possible. Unfortunately the Austrian elementary school is far from filling these requirements, but it can be stated that the matter is being taken in hand by the Austrian School Administration.

The following Table is taken from the *Oesterreichische Statistiches Handbuch für das Jahr* 1916-1917, pp. 11 and 55, Vienna, 1918.

Compulsory education for several years was first introduced into Austria in 1774, becoming compulsory during the reign of Joseph II (*d.* 1790). During the last 50 years, however, a modern law, brought in by M. HANSER

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(1) These questions are dealt with in an article published in the *Wiener Landwirtschaftliche Zeitung*. 1919, Nos 84, 91 and 92.

(2) See: "Zur Reform des ländlichen Fortbildungschulwesens", in the *Land und Forstwirtschaftliche Unterrichtszeitung*. Parts 1-2, 1917. Vienna.

TABLE II. — *Number of illiterate persons, and the average unit in Austro-Hungary.*

District	Illiterates of both sexes per 100 inhabitants over 10 years of age,	Average annual production in 1903-1913 in quintals per hectare	
	Per cent	Wheat	Oats
Upper Austria	2.4	14.4	11.3
Lower Austria	1.7	13.5	12.0
Salzburg	2.9	14.6	6.4
Styria	7.9	9.9	10.6
Carinthia	12.3	10.3	10.7
Carniola	12.2	7.7	9.6
Trieste	8.5	6.6	5.3
Gorizia	15.5	8.3	9.5
Istria	39.8	5.2	4.1
Tyrol	2.4	13.4	10.6
Vorarlberg	0.8	8.0	6.6
Bohemia	2.1	16.3	14.8
Moravia	2.9	14.3	12.5
Silesia	3.7	11.7	11.5
Galicia	40.6	10.3	10.2
Bucovina	53.9	13.3	13.7
Dalmatia	62.8	6.0	4.1

concerning elementary schools gives, in Art. 75, ample scope for the peasants to evade compulsory education.

It is interesting to note that in those parts of Austria with a population largely illiterate and where compulsory education is not enforced, lack of education goes hand in hand with low production.

6 - **Domestic Economy and Agricultural Schools for Girls in Italy.** — SAVAZZINI, G., (Director of the Cattedra di Agricoltura, Ossola), in the *Giornale di Agricoltura della Domenica*, Year XXX No. 47, pp. 371, figs. 2. Piacenza, Novem. 21, 1920.

The only girls schools of this type are: A practical agricultural School for Girls at Niguardo (Milan), an Agricultural Domestic Economy school at Florence (Cascino), affiliated to the School of Pomology, and a Domestic Economy School at Bergamo. General GIBELLI, of the agricultural committee of Milan, has organised several domestic economy schools, but more for the young factory girls than for daughters of peasants.

The author asks the local Ambulatory Chairs of Agriculture to advocate the establishment of these schools wherever small holders are numerous. As an example he describes the working of the School of Domestic Economy and Agriculture of Ossola, which he founded at Varzo (near Domodossola, province of Novara) and which is equipped for practical instruction in domestic work, cheese making, field cultivation etc.

[5-6]

The students are divided into groups, which carry out the various tasks in turn, in a way similar to that practised in the Belgian agricultural Schools for girls (1).

7 - **The Italian Agricultural Society.** — *Atti della Societa agronomica italiana*, Year 1, No 1, pp. 1-27. Rome, 1920.

On July 18, 1920, the Italian Agricultural Society was formed by Italian scientists engaged in the study of agricultural problems for the purpose of encouraging and co-ordinating scientific research and experimental work in agriculture and related industries.

The programme of the Society is as follows: —

(1) To institute, organise and assist scientific research and experiments.

(2) To inquire into agricultural problems.

(3) To provide scientific criticism of the Italian agricultural movement and of all manifestations by public bodies in relation to agricultural study.

(4) To undertake and help publications in conformity with the aims of the Society.

(5) To institute a department for scientific documentation.

(6) To manifest, eventually, activity in a consultative capacity

The following foundamental principles, proposed by Senator Prof. GRASSI, were adopted:

I. — The Society relies chiefly upon the individual efforts of the members. Each specialist in a certain branch may report a problem or group of problems to the directing Council, which has the task of directing the activities of the Society by organising study and research on a large scale, by encouraging young workers and by coordinating ideas and experiments.

II. — That pressure should be brought to bear on the Government to make it consider schemes put forward by the Society and provide the necessary means.

The Society will begin its work by the organised and systematic study of the following 5 subjects with upon the help of its members and the technical and financial support of all those who study or are interested in such subjects:

(1) Research concerning the best method of utilising arid soils for the cultivation of crops of economic importance paying particular attention to their resistance to the dryness of the substratum (BORZÌ).

(2) Determination of the yield capacity of soils in the south of Italy, chiefly in connection with their exposure and the cultivation of wheat (RIVERA).

(3) Research on the utilisation of leucite as a source of potash especially as regards Italian agriculture (BORGHESANI).

(4) Research on the causes of citrous root rot (BORZÌ).

(5) Research on insects harmful to the olive (GRASSI).

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(1) See *R.* July-Aug. 1920, No. 713 (*Ed.*)

CROPS AND CULTIVATION

8 - **Agricultural Climatology of Australia.** — TAYLOR, GRIFFITH, in *Quarterly Journal of the Royal Meteorological Society*, Vol. XLVI, No. 196, pp. 331-356, figs. 9, bibliography of 7 works, London, Oct. 1920.

WHEAT. — This crop is by far the most important in Australia, and constitutes 69 % of the area cultivated. Only in Queensland (26 %) and Tasmania (10 %) does it occupy a subordinate position. Table I indicates the production and climatic controls in the several States.

The primary control is the rainfall, but it is not the total precipitation so much as the amount which falls during the growing period which determines the wheat belt.

There are obviously vast areas suitable for wheat which have not yet been developed. In the early stages of wheat growing in Australia, mistakes were made and progress was slow. Cultivation was confined to the moist coastal country with its annual rainfall of 30 to 40 inches.

TABLE I. — *Wheat* 1917-1918.

State	*Bushels*	Temperature April-Oct.		Rainfall April-Oct.	
		Whole	Optimum	Whole	Optimum
New South Wales	37 800 000	16.11° – 11.11°	16.11° – 11.11°	625–225	375–275
Victoria	37 700 000	12.70° – 11.11°	12.78° – 11.11°	625–200	375–250
South Australia .	28 700 000	14.44° – 12.22°	13.89° – 12 78°	625–150	500–250
West. Australia .	9 300 000	17.22° – 13.89°	16.67° – 13.89°	750–250	500–375
Queensland. . .	1 400 000	16.67° – 15.56°	—	500–250	—
Tasmania. . . .	250 000	11.11° – 7.78°	—	1000–250	500–375
Total . . .	**115 150 000**	—	—	—	—

TABLE II. — *Areas receiving over* 10 *inches of rain April to October and areas actually cultivated.*

State	Over 10 inches	Area under wheat
	sq. miles	sq. miles
New South Wales	163 772	5 000
West Australia	93 500	2 000
Queensland	79 247	230
Victoria	74 616	4 200
Sout Australia.	46 980	3 700
Tasmania	26 215	340
Total . . .	**484 330**	**15 470**

It was only later on that the discovery was made that wheat could be grown much more successfully in districts where the rainfall is 25 inches or under. On well worked *fallowed* land it is stated that splendid crops have been harvested, although the rainfall only amounted to 2 or 3 inches during the growing period. However, it is not the quantity of rain which is important but also the time of year in which it falls. Rain is wanted in the early autumn so that ploughing can be done, and in the spring when the wheat is heading and flowering. Rain in April and May, and again in September or October, ensures a fine crop. The summer is usually dry and warm which conteracts the fear of rust and facilitates hay making.

In districts which have most of the rain in the summer, wheat cultivation becomes practically impossible. Swanland (W. Australia) and New South Wales, present in this sense the two extremes; in the former the rainfall in winter is reliable, and in the latter the summer rains are unreliable and therefore contrary to wheat growing.

In most of the wheat areas the crop depends very largely on the rainfall stored in the soil from the previous year. The actual rainfall during growth may be only 7 inches or even less, but this is supplemented by the fall while the land is lying fallow.

In New South Wales, the practice is to plough the land in July or August to a depth of 4 1/2 to 5 inches, and then to let it lie for 6 weeks, when it is harrowed. The fallow receives frequent workings with the cultivator so as to form a loose mulch, which checks evaporation. This operation is repeated, until sowing time in April or May. The majority of districts enjoy an annual rainfall of 20 inches or less, and only from 6 to 8 inches of this falls during the growing period.

In New South Wales, the most productive region is the Riverina around Corona, and thence north to Molong. The county of Hume is a probably the most productive centre for Australia. The relation between the wheat isopleths and the winter isohyets is extremely close. The 10-inch line is the western boundary of the wheat area, whilst a rainfall of over 20 inches in the wheat period practically fixes the eastern boundary of the State, for only around Sydney is a little wheat grown in wetter districts.

But, until the railways are much more numerous, there will be large areas of wheat land unoccupied. The farthest distance from the railways to make wheat growing profitable, should not exceed 18 or 20 miles.

A revolution in wheat growing may be said to have taken place with the advent of " Federation " wheat and other new varieties produced by **Farrer**. Such an extensive range is provided, that farmers can now begin sowing at the end of March, and continue through April, May and June and finish with certain varieties at the end of July. The early sown varieties ripen later, and so the harvest ripens in stages and can be more readily handled.

In Victoria, the greatest area under cultivation lies in the north and north-west. The countries of Rodney, Moira and Wimmera fall within the rainfall controls specified earlier.

In addition to this, around Sale is a small wheat district in the wet region of Gippsland, and this is due to the low rainfall of a *rain-shadow*.

In the same way the rain-shadow to the south-west of Melbourne includes the drier coastal counties which grow wheat. In the Victorian Mallee, is a large extent of sandy loam country with a light winter rainfall from 10 to 15 inches. For a long period this land was deemed unfit for wheat, but experience has proved that it is quite profitable when properly worked on the *dry farming* 3-year rotation system of fallow, wheat, grazing There were 800 000 acres under wheat here in 1914.

In South Australia, there is a northward bulge in the isohyets caused by the Flinders Range and possibly influenced by the long gulfs running 200 miles into the continent. Here 6 counties around St Vincent Gulf each produced more than 2 million bushels for the season on 1915-16. The climate is ideal for wheat culture, nearly all the rain falling in winter. The 6-inch winter rainfall line seems to mark the outer line of wheat culture

OATS. — This grain only represents 5 % of the area under cultivation in Australia. Victoria has produced 55 % of the total, Tasmania is the next State, while South and West Australia are nearly as important. The distribution of the main crop differs considerably from that of wheat. The chief region is in the Central District around Melbourne, while the Wimmera region ranks next. Hence the temperature is 5° cooler than that for the chief wheat districts while the rainfall is heavier and the evaporation less. The whole of Victoria, — excluding the Mallee the mountainous districts east and Gippsland — is, however, very largely interested in the oat crop

In the other states, the limits are much the same as for wheat, save that a fair crop is grown along the cool wet south coast of New South Wales, where hardly any wheat is found. The most northern crop is in Queensland around Gayndah, where the average annual temperature is 70°.

SUGAR. – This crop is confined to the well watered east coast. The sugar is all derived from cane, apart from a little sugar beet grown in Victoria. The cane plantations extend down the east Queensland coast and into New South Wales.

The appending Table shows the climatic controls of the chief sugar cane fields. (See Table page 16).

In Queensland, sugar cane comprises ⅓ of the agriculture of the State (about the same as maize), and is worth more then 3 millions sterling annually. The plantations are confined to the narrow belt between the highlands and the sea. The rainfall is sufficient in most of the plantations, except in the Bundaberg and Ayr districts, where irrigation is practised. Cane-cutting is done chiefly in June and the followng cooler months.

In New South Wales, the sugar crop is less than 0.50 % of the total crops. It has been gradually driven north by fear of frost,and is now confined to the Grafton-Lismore region in the extreme north.

MAIZE. — About 93 % of the whole is grown in Queensland and New South Wales, in the littoral to the east of longitude 150°. Hence it re-

TABLE III. — *Climatic controls of chief sugar cane Fields at sugar sure.*

Latitude	Locality	Approximate Temperature	Annual Rainfall	Area of sugar 1917
16	Douglas	78 °F	83 inches	24 000 acres
17	Cairns	76	90	
17 1/2	Mourylian	76	159	34 000
18 1/2	Ingham	76	80	
19	Townsville	76	50	22 000
19 1/2	Ayr	75	45	
20 1/2	Proserpine	75	42	6 000
21	Mackay	72	68	42 000
24	Gladstone	71	41	600
25	Bundaberg	70	44	25 000
25 1/2	Childers	70	42	18 000
26 1/2	Maroochy	69	65	2 000
27 1/2	Rosewood, etc.	69	32	2 000
28	Nerany.	69	58	400
29	Lismore	68	70	11 000
30	Mac Lean	68	47	

quires for the best results a rainfall exceeding 25 inches and a temperature not less than that of Sydney (January 72° ; July 52°).

BARLEY. — South Australia and Victoria contribute 85 % of the total production. The crop is grown chiefly in the wetter and cooler portions of the wheat belt. In South Australia, Yorke's Peninsula and the Gämbier region are the chief centres; in Victoria, round Werribee; in New South Wales, in the Riverina.

VINEYARDS. — These are naturally confined to the well watered portions of the continent; South Australia and Victoria contain 80 % the vineyards. The localities lie between the 65°F and 55°F annual isotherms and (excluding irrigation settlement) are all between the 20 and 30-inch annual isohyets. Hence the climatic controls are very well marked.

POTATOES. — 80 % of the total crop is produced in the 3 States of Victoria (52 %), Tasmania (18 %) and New South Wales (12 %). In the last State the chief crop is grown on the slopes west of Bathurst and Goulburn and on the northern tableland and Glen Innes.

These regions all have about 30 inches of rain yearly.

9 - **Effect of the Weather on Crops in Alaska in 1918.**— GEORGESON, C. C., in *Report of the Alaska Agricultural Experiment Stations*, 1918, pp. 7-8, Washington, 1920.

The weather conditions play an important part in the operations of the Alaska farmer as the country is so close to the borderland of possibilities that a little shifting of temperature and rainfall may have a distinct influence on the final results as regards yield.

Nevertheless, the prevailing conditions are not so discouraging as might be expected at first sight considering the geographical situation.

During 20 years the crops have never been completely killed off by frost in June or July, as sometimes happens very much farther south in Canadian territory, or even in North Dakota.

In any case, the season without frost is always very short, which engenders the necessity of cultivation of grain crops which ripen very early and before the arrival of the autumn frosts. During the six years that an experiment station was in working order in the Copper River Valley, a fatal frost occurred about the middle of August every year, and grain that had not matured in time was fit only for hay.

The season of 1918 suffered a very severe winter, accompanied by a heavy snowfall which averaged more than 4 feet in depth in the Yukon and Tanana valleys. The total snowfall was between 5 and 6 feet. This was followed by a very late cold spring which made the sowing time 2 weeks later than normal. This is always a serious drawback in the case of grain crops, as the growing season must be correspondingly prolonged in the autumn to permit them to mature. The late spring was followed by a hot dry early summer. Wherever there was moisture enough in the soil, the growth was rapid for a time, but the grain was invariably stunted, and some of the late-sown seed especially in the Tanana valley, did not have moisture enough to start growth and therefore laid dormant until the rains came late in the summer. The result as a whole was short straw and a comparatively light yield.

Frost did not occur, however, until August 26 and 27, and fatal frost did not occur until the first week in September.

10 - Effect of Temperature upon the Polar and Altimetric Limits of Tree Growth.

— KOPPER, W., in the *Meteorologische Zeitschrift*, Vol. XXXVII, Parts 1-2, pp. 39-42. Brunswick, February, 1920.

There are certain regions of the globe where, either on account of the low temperature or the prevailing dryness, no trees can grow. Certain limits of cold and "aridity", however, can be passed by direct means, such as irrigation, artificial reduction of evaporation, protective measures against cold, etc., or by indirect means, e. g., defending a species from the competition of others more adapted to the climate and which if given full liberty of propagation would entirely suppress the weather plant and oust it from the limits of the zone. Protection against wind is of considerable importance in this connection; as is also the duration of the vegetative period.

In the present paper, the author studies the cold limit from the points of view of latitude and altitude.

The action of temperature upon metabolism is so complicated that it cannot be expressed by means of a simple formula, or by exact meteorological values, all the more, seeing that most stations and observatories possess no data on the temperature of the soil and on the amount of radiation.

On the other hand, the influence of meteorological factors is so important that even the study of the connection between the temperature of the air, the different phases of plant development, and the distribution of groups that have been determined systematically and physiologically, suffices to reveal many interesting correlations.

Such a correlaton is found between the isotherm 10° C. of the warmest month, and the polar limit of tree growth, the 2 curves coinciding almost completely. Sust'as in average and high latitudes, the mean temperature of the air is higher on the continents and inland than it is on the coast, so in like manner, the polar tree limit extends further towards the pole and attains higher altitudes in a continental, than a maritime climate.

Trees have been observed to cross the thermal limit of 9° C (for the hottest month in the year) in two districts, i. e., the Central Alps and Cape Horn.

From the Rigi and the Säntis, as far as the Upper Engadine, the tree limit rises by 550 m. (from 1745 to 2300 m.), whereas the July isotherm of 10°C. only rises 230 m. (from 1760 m. to 1990); in the Upper Engadine, the temperature of the hottest month is only 8° C.

Similar conditions exist in the region of Cape Horn: near the Beagle Channel trees grow up to 600 m. at places where the temperature of the warmest month cannot exceed 6° to 7°C.

On the other hand, there are places with a temperature during the warmest month it 10° C. or even more, where no trees will grow. This is the case in the Orkney and Shetland Islands, though the August temperatures there are 11°6 and 12.2°C., respectively. The Scottish Highlands are very poor in trees, and the limit of tree growth is reached at between 600 and 810 m. with July temperatues of 10°5 C. and 9° C, respectively.

It is an interesting fact that the Falkland Isles (February 9.6° C). unlike ,Tierra del Fuego, are completely bare of trees, and that the Faroe Islands (July, 10.8° C), even trees which are artificially planted and receive every care, take root with difficulty . It would be well to make acclimatisation experiments there, with the strong varieties of beech growing at Cape Horn.

11 - **The Spring Awakening of Arable Land.** — LUMIÈRE, A., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 18, pp. 868-871. Paris, November 2, 1920.

In the temperate zones, the arable land awakens at the end of winter to greater activity, which is chiefly shown by the germination of the seeds it contains, and by the recrudescence of nitrification in the soil.

Putting aside the suggestion advanced by MÜNTZ and GAUDECHON, that this re-awakening of the land in spring is due to the atavism of the micro-organisms (1), the author has sought to discover another cause of this seasonal rhythm, and has put forward the hypothesis that an important part in the phenomenon in question is played by the toxic products secreted by the roots of plants, or resulting from the transformation of plant remains after the fall of the leaves and the death of annual species, for a certain time is needed before these toxic products can be destroyed by fermentation or oxidation, or can be diluted or removed by rain.

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(1) See, *R.*, Nov. 1913, No. 1241. (*Ed*).

This idea has been confirmed by the following experiment :— A sample of garden soil that had been under cultivation during the preceding summer, was taken by the author in November. This homogenous sample was divided into 2 similar portions, one of which was repeatedly washed with distilled water in order to remove most of the soluble matter present in it, while the other was simply watered with similar distilled water. At the laboratory temperature, the small plants that usually appear in spring, began to grow with great rapidity after a few days upon the surface of the washed soil sample, whereas the unwashed sample, although liberally watered, remained sterile. The washing had removed all the substances that prevented the germination of the seeds.

By extracting systematically the toxic matter in 10 kg., of the same soil, and then evaporating the washing water at a low temperature until reduced to 1 litre, the author obtained a reddish solution containing a total of 28 gm., of total solids. When this solution was used for watering, it absolutely prevented all germination, no matter what soil was selected or what the season might be.

Seeds soaked in this extract for some days did not lose their power of germinating, provided the extracts products, which did not seem to be actual toxins but merely inhibitory agents, were removed by thorough rinsing

The bodies preventing the germination of the seeds are not destroyed or even altered by heating them at 130° C. for half an hour in an autoclave, and would thus seem to be composed neither of toxins nor diastases.

The author is continuing his experiments, with a view to devising some simple and practical methods of either saturating or destroying these substances, as by this means it would be possible to improve, within considerable limits, the economic conditions of crops.

12 - The Phosphoric Acid in Sandy Humiferous Soils and in Their Solutions. —

BRIOUX, CH. (Directeur de la Station agronomique de la Seine-Inferieure Rouen, France) in the *Annales de la Science Agronomique*, Series 6, 1920, pp 80-86 Paris, 1920.

In normal, non-acid soils with an average humus content, the phosphoric acid is usually present in the form of tribasic calcium phosphate associated with a small quantity of iron phosphate and alumina ; a third part is combined with the black matter of the soil, and as a result of nitrification, is gradually placed at the disposal of the plants in a much divided form that is easily assimilated. On the other hand, the water surrounding the soil particles normally dissolves but very little of the phosphates, so that, as a rule, the solutions circulating in the soil and providing the plants with food, only contain some tenth parts of a milligramme of P_2O_5 per litre, and rarely more than 1 to 2 mgm., even when the soil is very fertile ; but the experiments of Th. SCHLOESING have demonstrated that these small quantities, which are continually renewed, are sufficient to ensure the complete development of maize grown in nutritive solutions.

The phosphoric-acid content of soil solutions is constant for any given soil, and M. DUMONT explains its variations in different soils by the variable composition of the humates and humo-phosphates present in them.

This suggestion seems to be borne ont by the experimental results obtained by the author, showing that the high P_2O_5 content of the solutions of certain soils is connected with the presence of a large amount of humic matters together with a deficiency in lime

These experiments were carried out upon humiferous, sandy soils composed of a coarse sand consisting entirely of silica, and which were originally yellowish, but from repeated manuring, had assumed the blackish hue characterising humiferous soils. They had an acid reaction, and were very poor in potassium and lime, and very rich in P_2O_5.

From his experiments, the author draws the following conclusions :—

In the case of sandy, humiferous soils without lime, the phosphoric-acid content of the soil solution appears to depend upon 3 factors, which are, in descending order :— (1) Lime content ; (2) amount of black matter ; (3) total phosphoric-acid content.

As soon as the lime content falls below 2 per 1000, the humo-phosphates can begin to dissolve to a noticeable extent in the water surrounding the soil particles.

Sandy humiferous soils enriched by very intensive cultivation are capable of giving solutions containing far more phosphoric acid than is generally recognised, and certain losses of black matter and of phosphoric acid may be due to the action of drainage water.

In order to derive most advantage from such soils, the first thing to do is to add lime, which will precipitate the humus more thoroughly, on the particles of sand and will give more stability to the phosphatic compounds. The lime will also promote nitrification and facilitate the double decompositions taking place between the fertilisers and the soil. It is equally necessary to add potash which is usually lacking in this type of soil.

Quick or slaked lime would be too violent in its action, and is best replaced by lime compost and, when possible, by soft chalky lime, more or less finely pounded, as its chemical action is in direct proportion to its fineness. The author obtained excellent results by adding to these sandy, humiferous soils 2000 kg., of pulverised chalk refuse per hectare, together with potassic fertilisers.

13 – **Copper in the Soil and in Plants.**— MAQUENNE, L., and DEMOUSSY, E. (*Bull. Soc. Chim.* p. 266, 1920), in *L'Industrie Chimique*, Year VII, No. 68, pp. 243-244. Paris, 1920 (1).

The presence of copper in the plant organism, first regarded as accidental, was recognised later as a normal occurrence. Now, however, it can be said that copper probably exists in all plants, for none of those examined so far have been found free from this metal.

The authors have found copper everywhere in the soil, but in very varying amounts. The result of their experiments is given in the following table, the average quantity of copper present being expressed in mgm. per kg., of soil, and the number of experiments being given in brackets: —

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(1) See *R.*. 1919, No. 568, and *R.*, 1920, 630. (*Ed.*)

	Mgm. per kg.
Aveyron high arable land (5)	2
Finistere, various crops, sandy heaths (landes) 10	20
Ille-et-Vilaine, garden soil, 52 Briac (1)	7
Seine-et-Oise, farm crop (5)	5
Lower Seine, pasture, various crops (11)	12
Yonne, soils under wheat and leguminoseae (9)	3
Brazilian soil, Santa Cruz (1)	25
Japanese soil (1)	10

Some exceptional soils show a considerable deviation in their copper content from the preceding averages. Thus, in the Department of Eure-et-Loire, 3 samples of soil were found with the copper content of 14, 19 and 30 mgm., per kg., respectively.

The soils of vineyards yielded the following figures: — 107 mgm., in the case of a vineyard in Herault that had been sulphated for 12 years; 43 mgm., in that of a vineyard sulphated from 1882 to 1915, but not since; 15 mgm., in the case of an unsulphated vineyard; a sulphated vineyard at Aigues-Mortes, in Clos-Lombard, 60 mgm.; a sulphated vineyard in Clos du Puits 30 mgm.; sulphated vineyards at Jarras 150 mgm.; uncultivated soil, 2 mgm.

The examination of these figures shows that very large quantities of copper are sometimes found in the soil of sulphated vineyards, the superficial layers containing as much as 200 to 300 kg., of copper per hectare. The metal is retained by the fine particles of the soil owing to their absorbant properties, and also by the chemical reactions in which they may be involved, so that the drainage water is only able to remove an infinitesimal amount. Vineyard soils thus become constantly richer in copper; their quality, however, does not vary, for they fix it with such energy that the plants are not able to assimilate too much,

What relations can be supposed to exist between copper and plants? The universal presence of the metal in the soil explains why it always occurs in plants. The authors have studied its distribution in the different organs of the same plant, and have reached the following conclusions: —

Copper is met with in all parts of the plant, which proves its great mobility. This power of migration can only belong to a substance that is soluble in the cell sap; this is, in fact, the case with copper.

It has been found that the copper is transported by preference to those parts where vital activity is greatest or about to become most intense. When the fruits are approaching maturity, the copper can be shown to move definitely towards them. The fall of the fruits is evidently one method of eliminating the copper absorbed by the plant during its active life.

Copper, in the right proportions, must be regarded as an essentially migratory element which travels about the plant at the same time and in the same manner as the nutritive principles, without in any way harming the tissues through which it passes. It may even be of use to them.

14 - **An Experience in Crop Production.** — JORDAN, W., H. and CHURCHILL, G.W. in the *New York Agricultural Experiment Station Bulletin* No. 465, pp. 1-20. Geneva, N. Y., June, 1919.

The experience covers 17 years of observations, 1896 to 1913, and the data given may be regarded as a report of progress. The experiment was extended over 4 years of rotations of 4 years each, the crops being maize, oats, wheat, barley and grass, in the order named, with the exception that 2 crops of maize were grown in succession during the first two years. The area of the field selected was 12 acres, and the 8 plats into which this was divided each covered 1 ½ acres. On 4 of the plats, with the 4 methods of treament, clover was included in the rotation, and in the other 4, receiving entirely similar treatment, timothy was included.

The points concerning which conclusions more or less definite may be drawn are as follows:

I. RELATIVE YIELD OF THE SEVERAL PLATS UNDER TREATMENT WITH: 1) FARMYARD MANURE; 2) COMPLETE COMMERCIAL FERTILISER AND 3) ACID PHOSPHATE, SUPPLEMENTED BY A SMALL APPLICATION OF SODIUM NITRATE. — The largest yield of crops, measured in terms of dry matter was with farmyard manure. Both this and the commercial fertiliser produced aproximately 56 % more dry matter than the plats receiving no fertiliser. The plats receiving phosphoric acid with partial nitrogen and no potash produced about 33 % more than untreated plats. In considering these figures, it should be kept in mind that the crops were produced under a system of rapid rotation, and also in 1910 all the plats had received 1 ton of burned lime per acre, previously slaked. The following Table shows the relative productivity of the several crops entering into the experiment :—

Yield of dry substance under the several methods of treatment
Area of each plat = 4 rods × 60 rods.

Treatment		Maize	Oats	Wheat	Barley	Hay	Total
		lb.	lb.	lb.	lb.	lb.	lb.
With clover in rotation	Farm Manure	48 659.9	17 036.3	20 636.5	4 973.3	27 061.8	**118 367.8**
	No fertiliser	32 998.1	12 422.4	9 059.8	3 555.1	14 818.4	**72 853.8**
	Partial fertiliser	41 273.0	17 184.7	15 563.5	4 381.1	21 689.6	**100 091.8**
	Complete »	45 442.5	19 451.0	20 418.9	4 882.0	23 722.8	**113 917.2**
With timothy in rotation	Farm Manure	42 932.0	17 898.2	19 311.8	4 206.1	25 211.4	**109 559.8**
	No fertiliser	34 615.2	12 812.8	9 198.0	3 343.4	20.649.6	**70 169.9**
	Partial fertiliser	40 731.6	14 941.2	14 727.4	3 670.7	14 921.5	**88 932.4**
	Complete »	50 489,0	17 191.3	17 251.5	5 013.0	16 353.1	**106 297.9**
	Total . . .	**337 141.6**	**128 937.9**	**126 168.3**	**33 964.7**	**164 428.2**	

The fact should be noted that the growth of dry substance in maize is over twice that in either oats or wheat, (counting the yield of barley as part of the wheat), or even of hay in spite of the fact that the crops of the cereal grains and hay were considered very satisfactory

The production of dry matter with the farmyard manure and complete commercial fertiliser was in the proportion of 118.3 for the former to 113.9 for the latter: If allowance is made for the difference in yield of hay due to the fact that timothy sod was maintained for only one year (it is a well known fact that more is necessary to obtain the maximum results) and comparison is made of the cereal crops produced, the relation of farmyard manure to commercial fertiliser is 91 to 90 with clover in the rotation, and 84 to 89 with timothy.

II. INFLUENCE OF CLOVER AS A FACTOR IN FERTILITY. — A comparison between the clover and timothy plats shows that in the 17 years there were produced of all crops, 29800 lb., more of dry matter on the former than on the latter. If, however, the comparison is made on the basis of the cereal crops, the difference in favour of clover is 13.500 lb., of drymatter.

These results indicate considerable advantage from the use of clover.

However a study of the yield of dry matter on the plats receiving no fertiliser, one with clover in rotation and the other with timothy, shows that production was maintained on the latter as efficiently as on the clover plats. The yields following the first rotation were maintained without any essential drop.

III. SOIL ANALYSIS AS A MEANS OF MEASURING FERTILITY. — A comparison of the analyses of the soil on the several plats before and after 17 years cropping showed no differences or changes which gave either any indication of the effect of the dissimilar systems of treatment or of the variation in productivity of the plats at the end of the 17 years.

IV. RELATIVE PROFITS. — From the figures tabulated with regard to the cost of fertilisers and the value of the crops, it is evident that the cheapest increase of production was secured by the use of acid phosphate, supplemented by a small proportion of sodium nitrate. Whether or not the increased yield from the use of the complete fertiliser with a maximum amount of nitrogen would be profitable would depend upon circumstances.

The experiment has since 1914 been conducted in new lines ; — the authors outline the general scheme.

15 - **The Necessity of a Change in Crop System in Canada and the Choice of Crops and Soil Productiveness.** — CUTLER, G. H., in *The Canadian Power Farmer*, Vol. XXV, No. 10, p. 18. Winnipeg, Oct 1920.

Reports indicate that in Western Canada, owing to the inroads of weeds, soil drifting and consequent increasing difficulties in the conservation of moisture, the former profitable crop yields cannot be maintained.

The underlying causes of the losses are considered to be due :—

(1) To the prevalent single cropping system, which results in multiplication and distribution of weeds, and in rapid reduction of organic matter in the soil;

(2) To the effects of blowing soil.

The author advocates the advisability of a wider choice of crops on systematic rotation and the use of grasses and legumes in conjunction with the cereals. Winter rye grass (*Lolium*) sweet clover (*Melilotus alba*) and sunflower crops would alleviate problems in soil productiveness. This acts as a pasture crop in autumn and spring, a protective crop against ground sweeps and soil blowing, a trap crop for snow and a fibre crop when used as summer pasture. Awnless brome grass (*Bromus inermis*) western rye grass and timothy (*Phleum* sp.), in conjunction with the aforementioned crops, will aid in the definite control of weeds and soil drifting.

Where there is limited rainfall and these conditions also prevail, the application of the outlined methods would be practically impossible and entirely impracticable. Extensive reclamation experiments are advocated in this case in order to utilise these large tracts for grazing.

16 – **The Value of Farmyard Manure on Utah Soils.** — HARRIS, F. S. in *Bulletin* No. 172. *Utah Agricultural College Experiment Station*, pp. 3-21. Table XIV, Figs, 12. Logan, Utah, March 1920.

A report of experiments on the value of farmyard manure in increasing the yield of various crops: 1) On irrigated land; 2) On dry farm soils. In the first case the trials were conducted on a deep rather fertile limestone soil at an irrigated farm at Greenville, but the dry farming experiments were carried out on clay loam soil at Nephi. Details are given as to the exact chemical composition of these soils etc.

RESULTS 1 IRRIGATED. — *With sugar beets.* — The following Table shows the average yields for the years 1918 and 1919 for the 5 ton, the 15 ton and 40 ton applications and for the years 1916 to 1919 for the other applications: —

Manure addet		Yield (Tons per Acre)		Increase due to manure		Increase in tons of beets for each ton of manure
		Roots	Tops	Roots	Tops	
Nil	. . . .	6.27	4.51	—	—	—
5	Tons	16.01	7.71	9.74	3.23	1.948
10	»	18.03	7.01	11.76	2.50	1.176
15	»	19.22	9.31	12.95	4.80	0.863
30	»	20.40	10.25	14.22	5.74	0.474
40	»	22.13	14.04	15.86	10.43	0.397

The increase per ton of manure is greater with the lower application and gradually decreases as the quantity of manure increases.

Potatoes. — A comparison between the results obtained on an unmanured plat and on a plat manured at the rate of about 10 tons per acre each year (1912-1919) showed that the average yield in bushels per acre was 150.8 on unmanured to 254.8 on manured, and the average increase in yield due to the manure was 104 bus.

A further experiment indicated that when manured at the rate of 5 tons per acre, the yield was increased by nearly 13 bus., per ton of manure, but when 40 tons were applied, the increase was only 4.3 bus., per ton.

Wheat. — An increase in yield was noted at the rate of 2.00, 1.13 and 0.33 bus. of grain respectively for each ton of manure when 5,15 and 40 tons of manure per acre were applied.

Oats. — An increase was noted at the rate of 1.65, 1.21 and 0.36 bus of grain respectively for each ton of manure when 5,15 and 40 tons per acre were applied.

Maize and stover. — The average of nine years of manure applied to maize gave an increase of 3.83 bus , of grain and 428 lb. of stover, and 1.61 bus., of grain and 214 lb., of stover respectively for each ton of manure when 5 and 15 tons were applied to the land each year.

RESULTS II : UNDER DRY FARMING. — The data with regard to the yield of Turkey Red wheat as affected by manure under dry farming during five years, indicate that although the returns are not so immediate as under irrigation there was however a distinct increase of 3.3. bus., per acre when 10 tons each alternate year were applied. The same average increase during 5 years was noted where 15 tons of manure were applied only at the beginning.

These results counteract the former popular idea that manure is of no value on the dry farm. On account of the low moisture content of the soil, the manure naturally decays slowly, but the returns will no doubt come in during later years.

17 - **The Utilisation of *Opuntia* spp. as Green Manure.** — See No. 59 of this *Review.*

18 - **The Industrial Utilisation of the Locust.** — SCHUGURENSKY, L., in the *Revista de Centro Estudiantes de Agronomia y Veterinaria de la Universidad de Buenos Aires*, Year XIII, No. 99, pp. 13-17. Buenos-Aires, April, 1920.

By means of analytical data and methods for extracting the fats and making concentrated cattle-foods and manure from locusts (1), the quantities of these insects which could be utilised in this way in the Argentine Republic can be estimated. According to statistics of the " Defensa Agricola ", season of 1916-1918, the number of locusts killed in the whole of Argentine, according to their different stages of development, was as follows :—

« Mosquita » (Newly hatched)		« Saltona » (Not yet able to fly)		« Voladora » (Adults)	
kg.	Hectares	kg.	Hectares	kg.	Hectares
38 410 521	138 717	371 715 227	289 865	439 951	6296

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(1) See *R.*, June, 1919, No. 690. (*Ed*)

The most interesting fact is that the largest number killed was in the coastal area, which would greatly facilitate transport for industrial use. This may be seen in the following Table:—

District	« Mosquita »	« Saltona »	« Voladora »
	Kg.	Kg.	Kg.
Buenos Aires	39 900	64 101 326	34 908
Santa Fé	976 370	53 734 311	—
Corrientes	1 944 900	21 005 700	118 748
Entre Ríos	3 896 185	63 359 850	95 772
Córdoba	17 355 549	74 345 704	165 428
Pampa	322 517	12 674 959	
Total . . .	—	**289 221 850**	

During the three years in question, an average of 96 000 metric tons of saltona locusts was killed yearly. Of this amount 30 000 metric tons was utilised, bringing in a profit of nearly 100 000 gold pesos (£240 000 at par) from the products obtained; the cost of the first works and of the preparation appear not to be very high.

19 – **Phosphates of Lime in North Africa (Barbary).** — JOLEAUD, L., Les richesses minières de l'Afrique du Nord (Maroc, Algerie, Tunisie), in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXIX, Vol. CXXXII, No. 4, pp 125-130 + figs. 2-5, 1 map. Paris, 1920 (1).

Certain of the Algerian and Tunisian phosphate deposits are localised north of the Sahara and south of the High Plateaux, at Gafsa, Tébessa, and in central Tunisia, whilst others are found north of the High Plateaux, at Tocqueville, and at Bordj-Reddir, all in Eastern Algeria and in the Regency. This is because the Algeria,, "horst", which emerged like the Sahara desert, at the period when the phosphates were formed, stretches from the Province of Constantine, where it is not extensive, takes on a considerable development to the south of Algiers, especially towards Oran, whence the name sometimes applied to it, "the Meseta of Oran", in comparison with the central plateau of the Iberian Peninsula.

This great stretch of tableland is interrupted in Western Morocco by the Middle Atlas Mountains and, as was to be expected, discoveries of phosphates have recently been made on the edges of this chain.

In the Atlantic Moghreb, west of the Middle Atlas, there is a meseta corresponding to that of Oran, called the Moroccan meseta, which embraces the countries of Zaïan, Zaer, Zemmour, Chaouia, Doukkala and Abda. Similarly, there are phosphatic formations between El-Boroudj and Oued-Zem, lying between the Moroccan meseta and the Upper Atlas Mountains. Perhaps in the future these beds also will be found to extend over larger areas on the borders of the Middle Atlas Mountains.

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(1) See *R.*, 1919, Nos. 827 and 829. (*Ed.*)

The formation of phosphate of lime in the shallower seas has been revealed by deep-sea dredging.

The facts stated above give an accurate account of the geographical conditions existing when the phosphatic deposits in North Africa were formed. At the beginning of the tertiary period, during the eocene, the sea extended over vast areas of Barbary, where there were two zones of very different geographical character, viz:—

(1) The Riff and it's approaches, the Algerian Tell and North Tunisia, where phosphates are scanty or absent

(2) Around the Moroccan Chaouia, on the Numidian High Plateaux, in Aurès, and in Central and Southern Tunisia, the phosphates are generally rich.

In Southern Barbary, occupied by a sublittoral sea, phosphates accumulated in certain localities in concordance with the former topography of Barbary. The dislocations which had affected its subsoil at the end of the secondary periods, at the ultimate place of the cretaceous, gave rise to submarine or emergent prominences which in time formed stops in the path of the marine currents. The frequency which the remains of sharks and crocodiles are found in these phosphate beds can be explained by the attraction that the accumulation of large quantities of organic débris on these stops had for carnivorous animals. Even to-day these animals are to be found in great numbers behind the bars off the shores of eastern Africa. It is at these points, where the marine currents stop behind the bars, that, during the eocene period, the remains of living creatures accumulated and formed nodules of phosphate of lime in consequence of a series of chemical reactions. By its decomposition at the bottom of the sea, the organic matter produced ammonia, which, reacting on the phosphate of lime in solution in the salt water, produced ammonium phosphate. This phosphate, coming into contact with carbonate of lime, also in solution in the sea water, was transformed into phosphate of lime, the particles of which became centres of attraction for more particles of phosphate; these may result from combination between the ammonium phosphate and the carbonate of lime resulting in the action on the sea-shells of carbonic acid in solution in the water.

In Barbary, rich beds of phosphate are always found in the same soil and in the same stage of the eocene series. The physical conditions of the marine areas of North Africa during the lower eocene, can easily be deduced from the distribution of fossil remains of various genera of fish in the phosphate beds, viz:—

(1) In the rich beds of Djebel-Ouk, in the Southern Province of Constantine, in Metlaoni, Redeyef, Ain-Moularès, and in South Tunisia, those species which are usually found near the coasts are fairly common, whilst those from the open sea are rare

(2) In the relatively rich beds of the zone south of the High Plateaux, at Kouif, Dyr near Tébessa, in Constantine, Kalaat-ès-Senem, Kalaa-Djerda and in Central Tunisia, the littoral species are only occasionally found and those from the deep seas are no longer very rare.

(3) In the poorer phosphate beds north of the High Plateaux, at Tocqueville, Bordy-Reddir, and South of Sétif in West Constantine, there are no littoral species but deep-sea remains are common.

(4) In the calcareous regions of central Tell, on the slopes of the Constantine Region, where the phsphate content is below 30 %, and has an indisputable effect on the fertility of the arable land, very little fish remains are found, and those all belong to deep-sea species.

(5) In the non-phosphatic calcareous regions of the coastal chains sharks' teeth are not found.

A certain relation thus exists between the variations in the phosphate content and changes in the fossel fauna of the eocene period, and this can easily be shown by the study of the shark's teeth.

Such are the facts deduced by the author from a comparative study of all the phosphate deposits, of North Africa. With the aid of these results it is possible to define clearly the regions where this valuable mineral fertiliser could be found in Barbary. The author believes that all workable deposits in Algeria and Tunis are known, but that in Morocco, from the southern border of the meseta to the limits of the Sahara there is yet a great deal of exploration to be done.

20 - **The Potash Salts of Upper Alsace and Their Utilisation in Colonial Agriculture.** — CHEVALIER, A., in the *Bulletin agricole de l'Institut Scientifique de Saigon*, Year II, No. 10, pp 289-297. Saigon, Oct., 1920.

The author gives a summary of the following works: —

1) A. WEHRLIN, F. BINDER, E. BOUCAR, E. REMY, G. DE PLACE, "Les Mines de Potasse de la Haute-Alsace", 1 vol., pp. 98 (extracted from the *Bulletin de la Société industrielle de Mulhouse*), Mulhouse, 1912.

2) P. DE RETZ "Rapport sur le Bassin de Potasse d'Alsace". This work has not yet been published but the proofs were lent to the author.

A report on the Théodor Mine was added, in order to inform the French Colonies about one or more valuable fertilisers for colonial agriculture.

The author describes the history of the potash mines of upper Alsace, the geology of the basin, the reserves, present state of working, future prospects, sales, and the agricultural use of potassic fertilisers. As regards tropical agriculture, data on the quantities of potash to apply per hectare for the chief crops are lacking.

The form under which the potash should be exported to the Colonies also requires to be ascertained. It should be remembered that natural powdered sylvinit as usually sold contains only 20-22 % of potash (K_2O). A crop, therefore, which requires 100 kg., of potash per hectare should receive nearly 500 kg., of the natural Alsatiam fertiliser. Pure potassium chloride only represents 63 % of potash.

In order to diminish freight charges, the author recommends the American method of importing concentrated potassium chloride of 90 per cent. purity, thus eliminating a large part of the sodium chloride ordinarily present in natural potash salts. All the Alsatian mines possess the necessary plant to do this. The potash salts as extracted from the mines are somewhat hygroscepic, and in damp tropical climates there is a risk of losing part of the pulverised fertiliser through the sacks.

Before the war the Union des Sociétés d'engrais potassiques at Stassfurt had commenced demonstrations in various parts of the world to show the utility of this fertiliser for tropical countries, but this was stopped during the war.

Most tropical crops, much more exhausting than crops of temperate regions, certainly require a far larger proportion of potash than crops in Europe.

It is high time that the scientific study of this subject should be taken in hand. Up to the present, the colonial use of fertilisers in the Colonies has been quite empirical.

The need for using artificial manures in colonial farming is increased by the scarcity in many countries of domestic animals capable of supplying natural manure and by the absence of cakes which could return to the soil some of the elements absorbed by the crops.

Alsatian potassium chloride is therefore called upon to render the greatest service to the colonies in developing all tropical crops and as these extend and improve so will it become necessary to import those fertilisers which are lacking in the colonies in increasing amounts

21 – **The Dynamics of a Fluctuating Growth Rate.** — REED H. S. (Graduate School of Tropical Agriculture and Citrus Experiment Station, University of California), in the *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 6, No. 7, pp. 397-415, Figs. 3, bibliogr of 3 works. Easton, Pa., July, 1920.

The quantitative study of the growth rate of shoots on a perennial plant was attempted in order to gain an insight into some kinetic aspects of the problem of growth. Measurements were taken of 70 selected shoots of " Royal " Apricot Trees which had been growing for two years in the orchards of the Citrus Experiment Station at Riverside, California. The observations were made during the growing season of 1918.

The growth of shoots was found to follow a definite though fluctuating rate. Analysis indicated that the seasonal growth consists of 3 distinct cycles of approximately 9 weeks each. The growth impelling agency was at the maximum at the beginning of the season and diminished as growth proceeded. In the first 7 or 8 weeks the rate declined more rapidly than in any other period. From the 8th to the 19th week it was fairly constant, only diminishing about 2.5 cm., and from then onwards the decline was considerably more rapid. At the end of the growing season the rate was less than $^1/_{10}$ of the initial rate. The growth in each cycle closely resembled the rate of an autocatalytic reaction and for the entire season it conformed to that of a reaction consisting of two unimolecular reactions one of which at first accelerated and subsequently retarded the other.

The author states that if growth be assumed to be proportional to the amount of active catalyst present, a method is available for studying the dynamics of the growth process.

22 – **The Influence of Cold in Stimulating the Growth of Plants.** — COVILLE, F. V. (Smithsonian Institution, U. S. National Museum, Washington D. C.), in the *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 6. No. 7, pp. 434-435. Easton, Pa, July, 1920.

The author gives contradictory evidence to the general belief that native trees and shrubs become dormant because of the cold, and that warm weather is in itself the sufficient cause of the beginning of new growth in spring.

Dormant trees and shrubs which had had two or three months of chilling, either outside or in artificial cold storage, started into growth in the normal manner in the spring, but if kept warm all the winter they did not start into growth at the usual time but continued their dormant condition for weeks and months, and sometimes for a whole year. When finally growth commenced it was of an abnormal character. One of these, dormant plants was found to be readily started into healthy growth even after a year, by subjecting it to a period of chilling. The best temperature for chilling was 32° to 40° F., applied either in light or darkness. By subjecting one part of a dormant bush to a chilling temperature and keeping another part of it warm, the chilled portion was brought into full leaf and flower while the other part remained completely dormant.

During the process of chilling, the starch stored in the cellars is transformed into sugar and this is necessary before the plant can utilise its store of starch in making spring growth. If warmth alone would start growth, the stored food required by the plant for its normal vigorous growth the following spring would be wasted in a burst of new autumn growth, which would be killed by the first heavy frosts and cause ensuing weakness and probable death.

Further investigations are urged, especially in the determination of the proper temperatures for the storage of different kinds of seeds, bulbs, cuttings and grafting wood ; for the treatment of plants which are to be forced from dormancy to growth at unusual seasons, and for the storage of nursery stock so that the nurseryman may have plants in proper condition for shipment at any date.

23 - **The Influence of Nutrition and Root Activity Upon the Collapse and Desiccation Produced by Cold.** — PANTANELLI, E, in the *Resoconti della Reale Accademia dei Lincei*, Vol. XXIX, Series 5, Parts 1-2, pp. 66-71. Rome, 1920.

Continuing his researches on the effect of low temperatures upon plants, the author has carried out a series of experiments in order to determine whether the condition of the root system has any influence upon these phenomena, and if so, to what extent.

If the temperature of an organ is reduced to near freezing point, an increasing permeability of the cell is brought about. This shows itself by the rapid emission of water from a tissue that has been kept dry, and by the exosmosis of substances from a tissue immersed in water.

The fact is general: an examination, with the naked eye or a microscope of plant organs, and especially of thin leaves, reveals the fact that during great lowering of temperature the cells contract, their contents being ejected into the intercellular spaces: the loss of turgescence is shown outwardly by wilting.

In order that turgescence be restored with the elevation of the temperature, it is necessary that the water which has been expelled into the intercellular spaces, should be re-absorbed by the cells. This cannot take place, should the water have evaporated either during the lowering of the temperature, or as a result of raising it. In this case, the evaporated water must be replaced by root action, otherwise the organ will wither definitively, although it has not been killed by the cold.

The state of the roots is thus of the greatest importance in re-establishing turgescence, if the organ is to repair the injury caused by the cold.

(1) The renewal of root activity after cooling is rapid in proportion to the injury the root system has suffered and as the soil regains its warmth more quickly. It has been found that the acidity of the soil and a liberal supply of phosphates, render the roots more resistant to cold, whereas the alkalinity of the soil and a generous application of nitrogen make them more susceptible to it.

In the first case, the roots begin to work as soon as the temperature rises, in the second they are a long time in functioning, so that the transpiration organs wilt completely and all the more rapidly, the more the permeability of the cells of these organs has been increased by the lowering of the temperature.

(2) In a second series of experiments, the author studied the effect of soil moisture upon resistance to cold, and subsequent recovery of aerial organs. For this purpose pot cultures were watered with different quantities of water, so that the moisture of the soil was maintained approximately at 5, 10, 20, 40 and 60 % (as compared with soil dried at 100°C.). At the moment of placing the plants in the refrigerator, these moisture percentages were carefully determined. During cooling, those parts of the aerial organs suffered most which were richest in water, but with the rise of the temperature to 15° C., the parts that had least suffered at once began to transpire again, even before the roots had re-commenced to function. Thus, in soil that was too dry, just as in soil with too high a water content, the plants received a insufficient supply of water and withered. This was more striking in the case of the haricot then in that of the chick pea, for as the aerial portions of the former resist cold better than those of the latter, they begin to transpire again more quickly as soon as the temperature is raised.

(3) It is not, however, enough for the root to regain its absorbent activity in order to restore the turgescence of the aerial organs after thawing. It is necessary that the water should rise from the roots to the stem and thence to the leaves, and as it is the living cells that pump the water into the wood-vessels, it is of interest to ascertain how much the interference in the conducting function has to do with the total injury to the plant.

In order to determine this, the author placed in the refrigerator entire plants of garden beans, 60 cm., in height, that had been grown in nutritive solutions, or only the stalks or even tips of the stems placed in the same solution, or in spring water.

The detached tips suffered less than the entire plants, because they absorbed water more easily after the temperature was raised. The stems cut at the root-collar suffered more than whole plants, since the water had to travel a long distance without the assistance of root-pressure, and because the cells that cause the ascension of the sap had suffered from the cold.

Encouraged by these results, the author limited the action of the cold to one part of the plant, by affixing small glass receptacles filled with a freezing mixture to the root, part of the aerial organs, or to a portion of the stem without detaching it from the rest. When only the aerial portions were subjected to the action of cold, they did not lose their turgescence until the temperature had fallen lower than that which sufficed to render them flaccid when the roots were also treated, whereas it was enough to cool down the soil, that is to say the roots, in order for the stems to lose their turgescence at a temperature which was much higher than that which affected the entire plant. If the stems alone were subjected to the action of cold, they quickly regained their turgescence as soon as the temperature was raised (unless the temperature had been lowered to the fatal point), whereas if the roots had also been affected by freezing, the stems remained flaccid for some hours, or even longer, and if the roots alone had been treated, the effect was irreversible, and the stems withered.

All these experiments prove that root activity is a most important factor in determining the resistance of a plant to cold. Further, since the actual damage caused by cold is greater, the longer the part takes to regain its normal turgescence after the temperature is again raised, it is evident that the activity of the root plays an essential part in the restoration of the function of the aerial organs.

24 - **Respiration of Cereal Plants and Grains. — I. Of Sprouted Wheat; — II. Of Rice Paddy and Milled Rice; — III. Of Frosted Wheat Plants; — IV. Of Wheat Plants Infected with Stem Rust.** — BAILEY, C. H. and GURJAR, A. M. (Division of Agricultural Biochemistry, Minnesota Agricultural Experiment Station, St. Paul), in *The Journal of Biological Chemistry*, Vol. XLIV, No. 1, pp. 5-18, figs. 2, tables 6. Baltimore, Md., Oct., 1920.

Results of investigations in connection with the respiration of stored wheat have already been published (1).

I. — Attention was duly directed to determine the effect of sprouting upon the respiration of the grain, to ascertain whether or not this form of unsoundness on bulk grain could be expected to affect its keeping qualities.

A chemical analysis of the samples tested under varying conditions showed the normal wheat to contain 0.16 % of reducing sugars (calculated as dextrose), while the samples germinated 24 and 48 hours respectively, contained 0.59 % and 1.11 % respectively, — the ratios being 14.4 : 53.2 : 100 in the order named.

The graph and the Table establish the fact that respiration, and consequently the quantity of heat energy released per unit of time and material, proceeds at a higher rate in sprouted grain than in normal wheat. This should be of significance in commercial storage of bulk cereals, and in grading grain when the system employed takes note of the respiration and keeping qualities in storage.

Normal		Sprouted 24 hrs		Sprouted 48 hrs	
Moisture	CO₂ respired per 100 gm of dry matter in each 24 hrs	Moisture	CO₂ respired per 100 gm of dry matter in each 24 hrs		CO₂ respired per 100 gm. of dry matter in each 24 hrs
per cent	mg	per cent	mg	per cent	mg.
11.39	0.216	12.19	0.615	12.10	1.950
12.27	0.255	13.26	1.451	13.14	4.010
13.24	0.320	14.36	3.580	13.28	7.032
14.23	0.680	15.16	10.310	15.87	24.720
15.33	3.660	16.01	24.270	—	—
15.94	7.320	—	—	—	—

II — A series of samples representing rice paddy and its milled products at different stages of milling were secured in order to test the hypothesis that respiration was most active in the germ or embryo, and lowest in the endosperm. A comparison was made between the respiration of the rough rice or paddy and that of the rice from the "stone" and the "huller".

The treatment accorded them and the method employed were similar to those employed in the wheat studies previously reported (1). The graphs and Tables indicate plainly that the paddy respires much more vigorously than milled rice, and as milling proceeds the rate of respiration diminishes. Thus, the rice from the stones respires approximately 0.6 and that of the huller about 0.3 times as vigorously as the paddy.

The results of this study appear to support former evidence with regard to the seat of the most active respiration in a typical grain. It also shows that with different cereals, the relative acceleration of respiration with an increase in the moisture content of the grain varies with different species being greater in rice and its milled products than in hard wheat.

III. — Results of a study of wheat which had been frozen in the field before ripening (1) indicated that the grain thus frozen and subsequently thawed, respired more vigorously when stored in bulk than normal wheat of the same moisture content.

It was considered likely that the increased portion of substrate may have accelerated the reaction induced by the enzymes, and thus resulted in the respiration of more carbon dioxide per unit of time, and consequently the liberation of more heat energy.

Tests were carried out by freezing and then thawing the entire plant before ripening to discover if there was a difference in the respiration of such material and of plants not frozen.

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(1) See *R* June 1919, No 707. (*Ed*).

From the data secured it appeared that the frozen plants respired more vigorously during the first 24 hours after thawing than the others These suggest that the extent of damage to the grain, viewed from the milling and baking standpoint, may be indicated by the relative difference in respiration between plants frozen and thawed and others harvested at the same time but not frozen. But when a point is reached in the maturing where freezing and thawing do not accelerate respiration, it seems decidedly improbable that the grain will be affected in its milling qualities by such treatment. That moisture content is important is indicated by the data. Dessication accompanying maturity suppresses the activity of the enzymes responsible for respiration and doubtless similarly suppresses the hydrolytic enzymes which unfavourably affect the quality of the grain.

IV. — The following table shows the respiration of normal and rust-infected Marquis wheat plants harvested on August 9, 1917.

Sample	Moisture in plant	Weight per 1000 kernels of dried grain	CO$_2$ respired in 24 hours	
			Per 100 gm of dry matter	Per plant
	per cent	gm	mg	mg
Normal plants	56.08	19.54	2.904	61.46
Rust-infected plants . .	46.41	20.44	1.608	39.16

If respiration of these tissues is in any sense a measure of metabolic processes, metabolism was decidedly depressed in the rust-infected plants. It is considered that this may afford an index to the metabolism of such infected material, and the consequent effect upon the filling of the kernel.

25 - **On the Gaseous Exchanges between the Root and the Atmosphere.** — CERIGHELLI R. in the *Comptes rendus de l'Academie des Sciences*, Vol. CLXXI, No 13, pp 575-578 Paris, September 27, 1920.

It was demonstrated a long time ago that the root absorbs oxygen and gives off carbon dioxide. What still remains to be discovered is the proportion in which these gases are respeetively absorbed and exhaled by the subterranean organ, and whether, under certain conditions, the root is not also able to absorb carbon dioxide, and finally, what factors take part in the successive processes.

The author undertook a series of experiments on roots in relation to the aerial parts of the plant, and on roots that had been detached from them. The plants used in the experiments were *Senecio vulgaris*, *Lupinus albus*, and *Laurus nobilis*; the method employed was the confined-air method, and the analyses were carried out with BONNIER and MANGINS apparatus.

From the results observed, the author drew the following conclusions :—

1) When in a confined space roots respire like all other plant organs, oxygen being absorbed and carbon dioxide given off in such pro

portions that the ratio $CO_2 : O$ varies from 0.7 to 1, according to the species.

(2) When the roots are in contact with a very moist atmosphere, respiration increases; the amount of oxygen absorbed is greater than in a dry atmosphere, as is also the carbon dioxide given out, and the ratio $CO_2 : O$ remains constant (in the case of roots sectioned in pumice-stone).

(3) When the roots are in contact with a very moist atmosphere and connected with the aerial parts of the plant, respiration still increases, but all the carbon dioxide formed during the process is not completely exhaled, some of it being carried into the upper portions of the plant. in which case the respiratory ratio is very low. This phenomenon appears to be connected with the absorption of water by the root, for it seems that it is the absorbed water that carries with it the carbon dioxide

The author has never observed any absorption of carbon dioxide, at least in a gaseous condition. On the other hand, he thinks that the carbon dioxide originating in the root may play a more important part than that dissolved in the soil water, and absorbed at the same time as the latter.

26 - The Nitrogenous Matter and Phosphoric Acid Present During the Maturation and Germination of Wheat.

— ROUSSEAUX, E and SIROT, in the *Comptes rendus de l'Académie des Sciences*, Vol CLXXI, pp 578 580 Paris, September 27, 1920

In their previous work on the baking qualities of flour the authors have shown that in the flours made from normal, completely ripe and properly harvested wheat, the ratio of the soluble nitrogen to the total nitrogen present is almost constant in good baking flours. In flours that take badly, the proportion of soluble nitrogen varies from this constant (1).

Subsequently, they estimated the variations in the nitrogen, phosphoric acid and acid contents, not only of the flours but also of by the wheat itself. Analyses were made of average samples of wheat gathered every 5 days in the same field from the setting of the grain until the harvest; and then seeds from the beginning of germination until the emergence of the seedling. The results may be summarised as follows: —

The total nitrogen varies little; it increases and then decreases slowly and slightly as the carbohydrates increase. If, however, the percentage of the total nitrogen varies but little, the conditions under which it exists differ greatly. At first, 40 % of the nitrogen is soluble, but its solubility gradually decreases till only 9 % is soluble At this point, a fresh slight increase of solubility manifests itself, and 3 or 4 days later, an almost stable condition of equilibrium is reached, the proportion of soluble nitrogen being about 14 %. This stable condition appears to coincide with the chemical maturation that appears to precede the harvest by a fortnight. The ratio of soluble nitrogen to total nitrogen remains about 14 %, as long as the condition of the wheat is normal, but should it begin to germinate, the amount of soluble nitrogen rapidly increases rising to 26 % in the distended, germinating seed, and to 52 % in the embryo itself.

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(1) See *R.*, May, 1913, No. 605; *R.*, Mar., 1918, No. 343. (*Ed.*)

The behaviour of the phosphoric acid is in every way similar to that of the nitrogen ; the percentage is at first almost uniform, but falls from 76 to 30 % to rise slowly to, and remain at about 35 % In the germinating seed, it increases rapidly to 42 %.

The parallelism in the variations of the nitrogen and phosphoric acid is not without practical interest. It is possible to admit a correlation between a scarcity of available nitrogen in soils, and the low gluten content of wheats with a heavy yield, but it appears that this could not be remedied by the increased application of easily-nitrifiable nitrogenous fertilisers, unless a large supply of phosphatic manures were given at the same time.

During maturation, the acidity distinctly and regularly falls, declining from 0.300 to 0.016 to rise again to 0.048 in the germinated grain.

To sum up, wheat reaches normal and complete maturity when a state of equilibrium is reached, which as far as the nitrogenous and phosphatic matters are concerned, consists in the existence of a certain ratio between the soluble and insoluble materials. Any other ratios denote insufficient maturation, or a tendency to germination, which means that the condition of the wheat, or the flour, is more or less unsuitable for bread-making.

27 - **Development of Barley Kernels.** — I. HARLAN, H. V. (Agronomist in Charge of Barley Investigations, Bureau of Plant Industry), Daily Development of Hannchen Barley from Flowering to Maturity in *Journal of Agricultural Research*, Vol. XIX, No. 9, pp 393-429, figs. 17, pl. 9. Washington, Aug. 2, 1920. — II. HARLAN, H. V. and ANTHONY, S. (former Technologist in Bailey Investigations), Development of Barley Kernels in Normal and Clipped Spikes and the Limitations of Awnless and Hooded Varieties. *Ibid.* pp. 431-472, figs. 13, pl. 6.

I. — This paper presents data showing the growth of the Hannchen variety at Idaho from flowering to maturity taken at 12 hour intervals. This period in three successive years was 26 days The experiment differs in method from that employed by former investigators in the fact that there is a reduction of the period between the samples taken, and also an extensive study is made of the physical indices of length and diameter of the kernel.

In the early stages of development, measurable growth was observed daily and during 24 hour intervals. The length growth was completed by the seventh day, and as soon as the rate of growth in length decreased, the lateral diameter showed its most rapid increase. The dorsoventral diameter continued to increase almost until maturity.

Attention is drawn towards: 1) The effect of the position of the kernel on growth. Two main factors affected the relative size, *viz.*, age and the placing of the kernel on the spike. Graphs illustrate the comparative rate of development according to this position. 2) The course by days of dry matter, water, nitrogen and ash. The increase in dry matter was very uniform throughout the period of growth, and the water percentage decreased uniformly. The carbohydrates increased most rapidly and ash least rapidly. 3) The periods of development. This while steadily progressve from flowering to maturity, varied considerably in its nature. About the fifth or sixth day after flowering, the growth in length was checked and a rapid gain in dry matter began. About the ninth or tenth day a sticky substance caused the glumes to adhere to the kernel. About the fifteenth or sixteenth day, the kernel toughened, and the lemma began to lose colour in the centre of the dorsal surface. The awns which with this variety are more or less deciduous, dropt off in large numbers. This date coincided with the maximum water content of the kernel, and the end of the period of most rapid increase in dry matter and ash, and the completion of a stage of starch infiltration. From then onwards until maturity, the changes were gradual and differed only in degree. The only point which might mark a change of nutrition was found in those varieties which develop anthocyanin colours in the external layers a few days before maturity, but at present this is not known to be associated with any vital phase of growth or maturation.

A microscopical examination was made to determine the progress of the internal modifications that must accompany development. Plates illustrate starch infiltration at various stages. The first starch was found in the older cells in the middle of the flanks. The new cells added near the furrow developed in a way entirely comparable to the first cells of the starch endosperm. The actual date when growth ceases even where the external conditions are unusually uniform, must depend on the temperature and humidity at the time of ripening.

II. — There is a strong prejudice amongst farmers in the United States against the growing of barley because the long rough awns make the crop disagreeable to handle, the beards, in the straw and hay often cause sore mouths in stock, and the awns work into the wool of sheep.

The authors have proved the mistake made by clipping the awns in experiments carried out with the Manchuria barley in Minnesota and the Hannchen barley in Idaho. Both the material and the conditions were more favorable for satisfactory investigations in the latter district compared with the former.

In both cases the barleys did not yield as well as the bearded sorts and were readily shattered. It was evident and in accordance with former investigations, that the reduction in yield was not due to any injury to the plant, as the difference in growth was not apparent for several days after the awns had been removed and the kernels in both clipped and normal spikes were equally vigorous. It was only when starch infiltration became rapid that the awned spikes showed greater activity and resulted in a smaller volume and lower weight of dry matter at maturity with the kernels from clipped spikes than those from normal spike. There was only a slight difference in the quantity of nitrogen The water per kernel was a good index of development. Normally, the water rapidly increased after fertilisation and quickly attained the maximum. It then remained stabilised, or nearly so, as long as growth was efficiently maintained. When this was checked and maturation began, the water content dropt slowly until complete ripeness occurred. At this stage it dropt still more rapidly for two or three days. This was notably accelerated in the case of the clipped spikes. The average percentage of water in the normal spike was 34.19 on August 2nd

(Hannchen barley) dropping to 28.09 in August 3rd as compared with 32.1 dropping to 22.4 in the clipped spike.

The graph showing the percentage of ash in the kernels, rachises, paleae and awns of normal and clipped spike in this same barley showed that the awn contains a surprising amount of ash. At the flowering time, 10 % dry weight is ash, and at maturity 33 %. When the awns were removed this ash was apparently deposited in the rachis. It was in the rachis that the greatest and most significant difference occurred; the clipped spikes contained 25 % more ash than the normal spikes. This probably accounted for the tendency to shatter. Hooded and awnless barleys were found especially liable in this respect, and there seemed to be physiological reasons which accounts for this effect, namely: — the disposal of the ash as noted above, and also the removal with the awn of tissues and organs containing cells which can be used for storage purposes and which must necessarily cause some derangement of the normal processes of development.

The authors suggest the possibility of producing non shattering hooded and awnless sorts by using parents which normally have a low percentage of ash in the rachises. Several hundred hybrids with smooth awns have been produced and tested and several give promise of good yielding capacity. Whether varieties of this type can be made to yield equally as well as the awned sorts, remains yet to be determined.

28 – **The Molecular Concentration of the Sap of Vines.** — CAUDA, A and MENSIO, C. in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Parts 7, 8, 9, pp 317-331 Modena, 1920.

A knowledge of the molecular concentration of the saps circulating in plant tissues is of paramount importance in judging of the richness of the soil, measuring the rate of absorption of fertilising salts, tracing the accumulation of mineral substances in the plant, estimating the amount of salts circulating in the tissues during the different phases of the plant's development, and, in fact, in solving many of the problems of plant physiology.

The molecular concentration of the sap can be determined either by estimating the amount of ash, or by ascertaining the electric conductivity of the said sap, or by means of other physico-chemical methods. The authors adopted the method of determining the electric conductivity, and selected the vine as the subject of their experiments, using the liquid exuded from the " bleeding " stem of the vine, and sap expressed from the vine shoots. From the results set forth in a series of Tables, the authors drew the following conclusions: —

The liquid flowing naturally from the stems of pruned (bleeding) vines is rich in mineral and organic matters; and has an average concentration of 69×10^{-5}; this is a sign of the vigour and earliness of the plant. The determination of the electric conductivity seems to be the most adapted to the end in view, for it is influenced, not only by the amount of mineral substances present in solution, but also by the presence of organic matters, especially those with an acid reaction.

In vine sap, there is no absolute ratio between ash and extract though, as a rule, the ash amounts to from $^1/_5$ to ½ of the total extract.

The electric conductivity increases with the increase in mineral matter (ash) contained in the exuding sap of the " bleeding " vine. Therefore, given a constant quantity of mineral substances, the higher the percentage of extract, the higher is the electric conductivity.

There is a direct ratio between the acidity of this vine sap and the percentage of extract. The electric conductivity increases with the acid content, and attains a maximum after which it declines.

The concentration of the sap of the " bleeding " vine varies between vines of the same locality, between grafted vines and those growing on their own roots, and also according to the system of cultivation and the vigour and age of the plant. In young, robust vines, the electric conductivity is high; vines grafted on American stocks have more concentrated sap than those of the same variety growing on their own roots.

It is probable that the high electric conductivity of the sap of the " bleeding " vine is a sign of a heavy crop of grapes.

29 - **Studies on Self-sterility** (1). — EAST, E M (Harvard University), in *Genetics*, Vol. 4, No. 4, pp. 341-363, bibliography of 7 titles. Princeton, New Jersey, July, 1919.

In 1917, EAST and PARK described the belaviour of self-sterile plants in some detail, and a series of 3 papers in connection with this subject has now been issued dealing with: (1) The relation between self-fertile and self-sterile plants; (2) selective fertilization; (3) the behaviour of a number of families of self-sterile plants under various schemes of mating.

I. RELATION BETWEEN SELF-FERTILE AND SELF-STERILE PLANTS (" Studies on Self-sterility. " *Genetics*, 2, pp. 505-609. EAST and PARK). — Experiments made by COMPTON (1912-13) with *Reseda odorata* showed that: (1) Self-sterile plants intercrossed produced only self-sterile offspring. (2) Certain self-fertile plants then self-fertilised threw approximately 3 self-fertile to 1 self-sterile offspring. (3) These same plants when crossed with self-sterile individuals, produced self-fertiles and self-steriles, ratio 1 : 1. (4) Other self-fertile plants yielded none but self-fertile offspring from selfed seed.

These experiments were corroborated by the author by crossing *Nicotiana Forgetiana*, and *N. alata* with a third species. N. *Langsdorffii*, which is consistently self-fertile.

Data are reported showing that in *Nicotiana*, self-sterility is due to the presence of the allelomorph of a dominant fertility factor *F*. When a population is homozygous for this factor *ff*, it is self-sterile.

The factors which control the peculiar and systematic behaviour of self sterile plants when intercrossed among themselves are wholly independant of this factor, and the latter need not be considered in an interpretation of their expression.

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(1) See *R.* Nov.-Dec. 1920, No. 1077. (*Ed.*)

The manifestation of self-sterility as evinced by the degree to which pseudo-fertility shows, is due to as subsidiary inherited factor (or factors) but without the presence of the principal factor *ff*, there is no evidence that it functions.

II. SELECTIVE FERTILISATION (1). — The conception of the "gene" is unquestionably the foundation of genetics. The author considers that possibly the genes are arranged spatially, and a more delicate system of action is possible than with mere chromosome breaks. *The genes pass to either daughter cell by chance* and the gametes thus formed *mate by chance*. Experiments were made with the self sterile species. *Nicotiana Forgetiana*, *N. alata* and *N. augustifolia* to test the possibility of selective fertilisation. Comparisons were made between pollen tube frequency distributions of highly heterozygous and of comparatively homozygous plants, and also the influence of compatible matings on incompatible matings. In neither case was there any indication of selective fertilisation. Gametes are formed in may animals and plants, particularly in species crosses, which can never function.

The colour of *Nicotiana* pollen, the author states to be inherited as a maternal character; this corroborates BATESON'S experiments with sweet peas, in 1909. In BELLINGS work on the velvet bean (1914), 50 % of the F_1 pollen was found abortive in a certain cross. These facts point to the conclusion that unless mixtures of pollen from different individuals (or even spermatozoa) is used, selective fertilisation is quite improbable.

III. FAMILY OF SELF-STERILE PLANTS WHOLLY CROSS-STERILE. — The author has found it possible to obtain seed from truly self-sterile plants, and from combinations that are fundamentally incompatible and has kept records of infertile and fertile crosses made on 54 plants of one family, and a comparison between the number of seeds in the capsules of the presumably pseudo-fertile combinations in this family and the number of seeds in the capsules of the same plants when pollinated with pollen from the plant of F_2 generation (*N. Forgetiana* × *N. Langsdorffi*) ; and also records of pollinations made on 25 plants of this same family with a single sterile plant of F_2 generation of the above mentioned cross. The behaviour of a number of families of self-sterile plants under various schemes of mating was described in a preceding paper (*Genetics*, Vol. I, pp. 311-333) and this combined with the present work in progress leads the author to state that continued self-fertilisation is possible by persistent efforts of self pollination carried to the very end of the flowering season, and should bring about homozygosis in the secondary factors affecting the behaviour of self-sterile plants among themselves. When such a point is reached, the resulting population should not only be self-sterile but should belong to a single class all members of which are cross sterile with each other.

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(1) See *R.* Nov.-Dec. 1920, No. 1076. (*Ed.*)

30 – **Genetics of Rust Resistance in Crosses of Varieties of *Triticum vulgare* with varieties of *T. durum* and *T. dicoccum* from the Mendelian Standpoint.** — HAYES, H. K., in *Journal of Agricultural Research*, Vol. XIX, No. 11, pp. 523-542, pl. 6, bibliography of 27 works. Washington, Sept. 1920.

The artificially induced epidemic was produced with a known racial strain of the biological form *Puccinia graminis* f. sp. *tritici;* after first removing all *Berberis* bushes from the immediate vicinity of the rust plot in order to avoid infection by means of other biological forms of rust.

TABLE I. — *Rust infection of certain parent varieties and F_1 crosses between resistant and susceptible wheats.*

Variety or cross	Percentage of stem rust	Cross	Percentage of stem rust
Marquis	40 to 70 %	Marquis × Acme (C I 5284)	70 %
Preston	70	Preston × Acme (C I 5284)	70
Pioneer	40	Acme × Marquis	70
Acme	10	D–4 × Pioneer	40
D–4	10	Acme × Preston	70
Kubanka (C I 2094)	20	Marquis × *T. dicoccum*	10
Jumillo (C I 1736)	15	*T. dicoccum* × Marquis	10
T. dicoccum (Minn. 1165)	0	*T. dicoccum* × Preston	15
Marquis × Jumillo (C I 1736)	40	Preston × *T. dicoccum*	15
Marquis × Kubanka (C I 2094)	40 to 70		

Four durum varieties were then tested (Acme. D-4. Jumillo and Kubanka). The highest percentage of rust infection was 20 on Kubanka, while there was only 10 % on D.-4 and Acme.

Marquis, Preston and Pioneer were very susceptible to rust.

The behaviour of the F_1 cross was extremely interesting; whilst with an F_1, cross between *T. vulgare* vars., and durum wheats, susceptibility is a dominant character, a recessive character in crosses between *T. dicoccum* and common wheats was obvious.

For the purpose of determining possible interrelation between inheritance of rust resistance and other differential characters, the author undertook to determine the genotypic nature of individual F_2 and F_3 plants.

In the F_2 generation, numerous forms of *T. dicoccum, durum* and *vulgare* were evident, with various intermediary grades: Table II shows the predominance of the botanical characteristics of *T. vulgare* accompanied by a gradual susceptibility to rust.

Likewise in the cross *T. vulgare* × *T. dicoccum*, the author discovered an indication of linkage of durum or emmer's characters and rust resistance. It is, however, only a partial linkage, and if work is carried on with a large number of individuals, it will be found possible to isolate in F_3, plants possessing the characters of *T. vulgare* and the resistance of *T. durum*. In F_2 generation Marquis × durum, out of a total of 128

TABLE II. — F_2: *Marquis* × *Iumillo* (C I 1736) *and Marquis* × *Kubanka* (C I 2094).

(R — resistent — S = susceptible to stem rust).

Density	*Durum*		near *Durum*		intermediate		near *vulgare*		*vulgare*		*dicoccum*	
	R	S	R	S	R	S	R	S	R	S	R	S
Min.												
2.5	3	4	2	12	—	9	—	12	—	4	—	—
3.0	3	8	5	28	3	20	—	16	—	6	1	—
3.5	2	5	2	29	6	19	—	14	—	12	3	—
4.0	—	4	6	22	2	26	1	19	—	16	—	—
4.5	—	4	3	20	2	21	—	14	—	10	—	—
5.0	—	—	—	9	1	18	—	7	—	18	—	—
5.5	—	—	1	5	—	9	—	5	—	6	—	—
6.0	—	—	—	3	—	8	1	6	—	9	—	—
Total . . .	**8**	**25**	**19**	**128**	**14**	**130**	**2**	**93**	**0**	**81**	**4**	**0**
Ratio . . .	1 : 3.1		1 : 6.7		1 : 9.3		1 : 46.5		0 : 81		4 : 0	

common segregates, only 2 were rust resistant, but both of these were of little commercial value. However, several resistant plants with the head characters of common wheats were obtained in the F_2 generation. With the crosses Marquis × *dicoccum* 1165, and *dicoccum* (C I 1524) × Marquis, out of a total of 73 plants, only one was obtained in the F_2 generation which resembled *T. vulgare* and this was susceptible to rust. Several plants were obtained in the F_3 generation which were not only rust resistant, but also resembled *T. vulgare.* These facts show therefore, that it is possible to transfer the rust resistance of emmer wheats to common wheats by crossing and subsequent selection. There is, however a partial linkage between rust resistance and the emmer head type which makes it essential to grow large numbers in the F_2 and F_3 generations.

The mode of inheritance of rust resistance seems entirely comparable with the general mendelian manner of inheritance of botanical and morphological characters. The technique of breeding for rust resistance is similar to that of breeding for agronomic characters.

31 - **New Varieties of Wheat Obtained by Hybridisation in Australia.** —See No. 42 of this *Review.*

32 - **Development of Awnless and Hooded Varieties of Barley in the United States.** — See No 27 of this *Review.*

33 - **Occurrence of the Fixed Intermediate, Hordeum intermedium Haxtoni, in Crosses between *H. vulgare pallidum* and *H. distichon palmella*** — HARLAN, H V. and HAYES, H. K , in *Journal of Agricultural Research*, Vol. XIX, No. 11, p. 575-591, pl 4, bibliography of 9 works. Washington, D. C , Sept. 1920.

The cultivated barleys belong to the genus *Hordeum* and are characterised by the presence of 3 single-flowered spikelets at each node of the rachis.

The 6-rowed parents in all the hybrids studied, belonged to the variety *H. vulgare pallidum* and include Manchuria S. P. I. No. 20375, Sexradigt, Odessa, Reid Triumph, Surprise and a hybrid 6-rowed × 2-rowed barley. The lateral as well as the central florets of these varieties are long-awned and produce well-developed kernels. The 2-rowed parents all belonged to the variety *H. distichon palmella.* The central florets are long-awned while the lateral ones are awnless with rounded tips, and are sterile. Of the varieties here mentioned, Svanhals, Garton and Primus belong to this group.

In *H. intermedium Haxtoni,* the central florets are long-awned and produce normal kernels, while the lateral florets are awnless, as in the 2-rowed barleys, but fertile, producing undersized kernels. This form, obviously intermediate in character between the 6-rowed and 2-rowed barleys, has proved to be constant and fixed.

The cross Manchuria × Svanhals produced progeny amongst which the fixed intermediate occurred in the ratio 1 : 16 (approximately). The stability of this form was established by observations on intermediates obtained from several crosses. Some of these homozygous intermediates have been grown since 1912 with no indication of reverting to either the

6-rowed or the 2-rowed parental type. No 2-rowed segregates appeared among the progeny of the 6-rowed × *intermedium* crosses, and no 6-rowed segregates appeared among the pregeny of the *intermedium* × 2-rowed crosses. Every hybrid so far studied indicates that *H. intermedium* has a genetic rank equal to *H. vulgare* or *H. distichon.*

According to the results obtained with a large number of F_2 and F_3 progeny, a 2-factor hypothesis for fertility in the lateral florets is suggested. On the " presence-and-absence " hypothesis, the 6-rowed barleys are supposed to be homozygous for the presence of the epistatic factor A, the *intermedium* to be homozygous for the presence of the hypostatic factor B and for absence of the epistatic factor (*a a BB*), and the Svanhals to be homozygous for the absence of both factors (*a a b b*).

According to the hypothesis, there are 2 types of 6-rowed barleys. The Manchuria parent is supposed to be homozygous for the 2 factors (A A B B), while certain regressive 6-rowed segregates are thought to be homozygous for the presence of A and the absence of B. (A A bb).

F_2 is therefore constituted as follows : 1 AABB ; 2 AABb ; 1AAbb : 2 AaBB ; 4 AaBb ; 2 Aabb ; 1 aaBB ; 2 aaBb ; 1 aabb)

From the data collected in connection with the cross Manchuria × Svanhals, there is evidence suggestive of the existence of a third factor C. which affects the vigour of the lateral florets and their percentage of fertility.

34 – **The Inequality of Reciprocal Maize Crosses.** — RICHEY, F. D., in the *Journal of the American Society of Agronomy*, Vol. 12 Nos. 6-7, pp 185-196, 1 fig., bibliogr. of 15 works. Washington, D. C., September-October, 1920.

The author compares the yields of three pairs of recipricocal crosses between commercial varieties of maize and shows inequality in each pair. Data also are given which show that in one pair of these reciprocals the inequality is caused by the inheritance of some character from one of the parent varieties only when that variety is used as the staminate parent. The crosses were made by growing rows of the varieties used as pistillate parents between rows of those used as staminate parents and detasselling the former rows before they had shed pollen. In every case the maize was planted thick and later thinned to the desired stand. All yields were corrected to a basis of air-dry shelled maize.

Conclusion. — The author suggests that some type of sex-linked inheritance must at least be considered as a possible cause of inequality between the crosses as shown by the unequal transmission from the Selection " Fraley Yellow Dent " as staminate and as pistillate parent. A difference in the food materials furnished the young plants by the different maternal parents and in germinal reactions with different cytoplasms has been suggested as also a possible cause of inequalities.

35 – **On the Hybrid Euchlaena : Maize for Forage Purposes.** — COLLINS, G. N. and KEMPTON, J. H., in *Journal of Agricultural Research*, Vol. XIX, No. 1, pp. 1-37, pl. 7. Washington, D. C., April 9120.

The genetic relations of the principal characters of maize and teosinte (*Euchlaena mexicana* Schrad.) were investigated in a cross between the Tom

Thumb pop-corn and Florida teosinte, a large forage grass genetically distinct from maize. One of the objects of the experiment was to determine to what extent the characteristics of the parents would be dissociated in the hybrids, and to what degree of freedom, recombined. Would the much-branched habit of teosinte continue to be associated indefinitely with a teosinte-like inflorescence, or would profusely branched plants appear bearing maize-like ears ? Would the early maturing plants all resemble maize or would there be early plants having the desirable forage characteristics of *Euchlaena ?*

FIRST GENERATION (F_1). — The 4 normal F_1 plants were examined when about 18 dcm. high with 6 or 7 suckers arising from nodes below the ground. These suckers usually equalled the main stalks in height, but flowered several days later (similar to maize). The branching of the main stalk was not continuous ; one or two nodes usually failed to develop branches. The total number of nodes on the main culm ranged from 17 to 21.

The terminal panicles ressembled those of the maize in that they all had 8-rowed central spikes instead of 4 as in teosinte ; however, in 3 of the 4 plants this spike drooped as in teosinte.

The F_1 plants were comparatively uniform, and showed characters which, for the most part, were intermediate.

SECOND GENERATION (F_2). — The F_2 plants were also intermediate, with a greatly extended range of variation. Thirty-three of the characters that differentiate the parents were selected for examination. The distribution of the characters with one or two exceptions showed little or no evidence of alternative or Mendelian inheritance. With respect to the individual characters, the extreme variants approached, and in same cases exceeded those of the parents. Results in general showed the greatest freedom of recombination ; it is true that there were many instances of coherence or partial coupling of characters, but there were an almost equal number of instances where characters derived from different parents showed a tendency to combine more frequently than would be expected as the results of chance.

While there appeared to be no incompatible combinations, there were on the other hand no completely independant characters. Every character recorded showed significant correlation with other characters, and these in turn were correlated with still others with the results that all the characters were interrelated and formed a single group in which there is no coefficient of correlation lower than ± 0.31.

MENDELIAN INHERITANCE. — The nearest approach to Mendelian inheritance was shown by the arrangement of the spikelets in the pistillate inflorescence. In maize, the female spikelets are borne in pairs ; in *Euchlaena* on the other hand, thay are borne singly. Dominance of the male character was complete in the F_1 generation. In F_2 the segregation was not complete, there being many plants with both single and double female alicoles ; but the number of individuals in which double female alicoles predominated was approximately 3 times the number in which there were more single female alicoles.

It was found that the characters of the pistillate inflorescence were subdivided in transmission to a remarkable degree: Thus the maize ear, instead of behaving as a unit, was subdivided into a large number of separately inherited units all of which were inherited more or less independently.

PRACTICAL POSSIBILITIES. — A suprisingly large number of the plants combined the abundant production of suckers characteristic of the *Euchlaena* parent with the sturdy, upright character of maize, and resulted in very leafy compact plants of a type that should prove valuable for forage purposes.

It remains to be seen whether the new combinations can be maintained and made to breed true. The results of previous experiments with maize hybrids would indicate that selection for a few generations will fix any desired combination.

36 - **Contribution to the Technique of the Selection of *Brassica* Varieties.** — BECKER J., in *Zeitschrift für Pflanzenzüchtung*, Vol. VII, Part. 2, pp. 91-[illegible], Berlin December, 1919.

During the war, many apiculturists having no special knowledge of the subjects turned their attention, with the sole aim of making money, to the production and sale of the seed of selected varieties of *Brassica* (as they termed them), thus destroying, to a certain degree, the results of the patient and conscientious labours of specialists, who had gained for Germany world-wide reputation in this branch of selection work.

It is most necessary to repair the damage done. The article analysed gives the outlines of a method for the selection and improvement of the following varieties of *Brassica: B. oleracea capitata, B. oleracea sabauda, B. oleracea gemmifera, B. oleracea gongyloides, B. oleracea botrytis, B. oleracea acephala.*

From a field of homogeneous material, 3 or 4 plants with the desired characters are chosen and kept through the winter.

In the spring, these 3 or 4, individuals are planted together, and isolated, so as to form what is called the " reproduction lot ". The number of such plants should not exceed 4, otherwise the number of combinations in the progeny would increase to such a point as to make the further work of selection, and the fixation of types, both very difficult and less satisfactory.

The plants are lifted before they are ripe, and placed in a sheltered and covered place, where they can mature properly. The seeds from the *fifty* best stems are collected separately in small bags, whereas the rest are put into a single bag, and constitute the " second seed ". The separation of the seed from each stem is necessary, on account of the frequent variation in shoots that are thus isolated, and which must be taken into account, especially in the case of *Brassica*, where these variations are of somewhat common occurrence. Towards the end of spring, or at the beginning of summer, the seed of each stem is first put to germinate in filter paper, or Petrie dishes; as soon as the seeds have germinated, they are transferred with forceps to small pots 5 cm. in diameter (one plant being put in each pot), and the latter are sunk on in beds of manure 12 m., long and 1.5 m., wide; 7200 plants are placed in each bed.

As usually 20 seeds are taken from each inflorescence, and 25 out of the 50 stems chosen are set apart, 500 pots are necessary for each reproduction lot. Each bed can therefore contain the progeny of about 14 of the latter.

It is advisable to use pots, for these not only insure absolutely uniform conditions of environment to the seedlings, but also enable the latter to be planted out without any risk of injury.

When the crop is lifted (Sept.-Oct.), the 10 best plants from each family are taken, and put for the winter in a dry well-ventilated cellar; the rest being piled up in the fields and covered with a little soil (second lot).

In the spring, 4 out of the 10 chosen plants are isolated in a group, and allowed to intercross freely (the other 6 are kept in reserve). They are used for the continued production of *élite* seed. The plants of the second lot, which are to be used for breeding, are placed in rows, sufficient space being left between the latter to admit of free passage, and the carrying out of the necessay cultural operations. Naturally, in choosing and laying out the field, precautions must be taken to prevent cross-pollination, and the consequent production of hybrids.

The crop is lifted as soon as the inflorescences begin to wither: the yield varies within very large limits, it may be from 50 to 500 kg., per hectare; the seed collected is sufficient to sow from 100 to 1000 hectares.

Brassica seed can be obtained in 3 ways.

1) From *female parent plants* lifted in the autumn, stored during the winter, and planted out in the spring;

2) From *stumps* transplanted in spring, the cabbage-heads having been cut in the autumn; the stumps are left in the ground during the winter, and transplanted in spring for seed production;

3) From *cuttings;* these are planted in the autumn, they winter in the open field, and bear seed the following year. The author has carried out some experiments with a view to determining which of these methods is the best for obtaining a good seed yield. The following Table summarises the results of his work.

	Date of ripening of seeds	Average number seeds per plant	Average number of unfertilised flowers per plant	Average number of shoots (barren) per plant
Female parent plants. . . .	28 VII	1471	592	887
Stumps	7 VIII	857	573	284
Cuttings.	9 VII	630	227	453

The best results were therefore obtained with entire, well-developed mother plants, which had been kept through the winter, and planted out the following spring.

37 - **Crosses between Varieties of Brassica.** — RAGIONIERI, A., in *The Gardeners' Chronicle*, Vol. LXVII. No. 1753, pp. 60, London, July, 31, 1920. — *Giornale di Agricoltura della Domenica*, Vol XXX, No. 42, pp.334-335. Piacenza, October 17, 1920

The improved Chinese cabbage (*Brassica chinensis* var *Pet-sai*), which was placed on the market some years ago by Messrs VILMORIN-ANDRIEUX and Co., Paris, possesses qualities that attract the attention of those engaged in hybridisation. The chief points about this plant are its rapid growth, the large number and succulence of the leaves growing in the centre and forming an elongated ball, like a huge Roman lettuce, and its savoury taste. Some years ago, the author made the following crosses at Castello (Italy).

(1) *Brassica oleracea* (forage cabbage, one of the white and purple varieties ♀ × *B. chinensis var Pet-sai* ♂.

(2) *B. chinensis Pet-sai* ♀ × *B. oleracea* (forage cabbage, one of the white and blue varieties) ♂.

(3) *B. chinensis Pet-sai* ♀ × *B. oleracea botrytis cauliflora* (cauliflower) ♂.

(4) *B. oleracea botrytis cauliflora* (cauliflower) ♀ × *B. chinensis Pet-sai* ♂.

(5) *B. chinensis Pet-sai* ♀ × *B. oleracea capitata* (white-headed cabbage) ♂.

(6) *B. chinensis Pet-sai* ♀ × *B. oleracea acephala viridis* (green Scotch kale) ♂.

(7) *B. chinensis Pet-sai* ♀ × *B. Rapa* (common turnip) ♂.

(8) *B. Rapa* ♀ × *B. chinensis Pet-sai* ♂.

Ten flowers were cross-fertilised. Crosses Nos. 1 and 2, made in the hope of obtaining good, quickly-growing forage varieties, were of no practical use. The seeds of No. 1 were imperfect, No. 2 produced 4 seeds that germinated regularly and gave 4 stalkless, strong plants with leaves intermediate in character between those of both parents, but resembling in shape the leaves of the female parent " Pet-sai ". The colour of the entire plant was a greenish-white, turning to pure white in the centre. Although they were grown in a sheltered spot, all these hybrids died during the winter.

No. 3 gave a few more or less perfect seeds, 3 of which germinated and produced 3 seedlings resembling the female parent " Pet-sai " but with no traces of a head, either of flowers, or leaves. Two of these plants died during the winter, but the third was self-fertilised and bore some seeds, which though they appeared imperfect, produced fifty very vigorous, stalkless plants of which $^2/_3$ of the leaves were entire, like those of " Pet-sai ", and $^1/_3$ were lobed like cauliflowers leaves. None of these plants bore fertile seeds. Crosses Nos. 5 and 6 produced no fertile seed.

The most important results were obtained from crosses 7 and 8. The improved Chinese cabbage has great sexual affinity for the common white turnip. All the fertilised flowers produced perfect siliquas full of fine seeds that germinated quickly. All the hybrids of the first generation were very vigorous, and the offspring of these reciprocal crosses showed no sign of a large and rounded root. The hybrids resulting from cross No. 8 had rather broader fusiform roots than those obtained from cross No. 7. The leaves were very broad, lobed like those of the turnip, but erect like the leaves of " Pet-sai ", though they did not make a true head with strong veins over the whole surface. These plants, when selfed, produced an enormous amount of seed, and were perhaps even more fertile than their parents. The recessive character (presence of large round root, and entire leaves) reappeared in the second generation in the Mendelian ratio.

Some hundreds of the young F_2 plants showed great variation in shape, the roots in certain cases being round and fleshy and of different forms and dimensions whilst in others they were more or less elongated, like the root of the horse radish. Some of the globe-rooted plants had entire leaves like " Pet-sai ,, and others had lobed leaves like a turnip. The tendency to form a head was observed in some of the hydrids with turnip-like roots, and also in others with elongated roots. When boiled, the leaves of these plants are tender and have a good flavour. The young shoots, which grow in large numbers at the beginning of spring, can be served like asparagus.

These experiments show that whereas there exists a strong sexual affinity, between *B. chinensis* and *B. Rapa,* the pollen of the former species has but a very weak effect upon the stigmata of the varieties of *B. oleracea.*

38 – On the Behaviour of the Hybrids *Raphanus Raphanistrum* × *R. sativus.*

— TROUARD-RIOLLE, S. in the *Revue générale d. Botanique*, Vol. XXXII, No. 282, pp. 438-447, figs. 3. Paris, October, 1920.

From the cross *Raphanus Raphanistrum* × *R. sativus* (or from *R. sativus* × *R. Raphanistrum*), hybrids that were much more developed than their parents were obtained in the F_1.

M. SEGRET had also obtained a similar result in crossing the pink, white-tipped radish with a hybrid cabbage (a cross between Volga Russian and Curled Savoy). The cabbage-radish thus produced attained a gigantic size.

All the varieties of *R. Raphanistrum* used in the experiment had yellow flowers whereas, as is well-known, most varieties of this plant have nearly always white flowers, sometimes slightly tinged with pink or violet, corresponding to the red (or pink) and violet (or yellow and black) colouring of the roots.

Taken as a whole, the F_1 hybrids may be said to have had white flowers in the first year. But this rule was not absolute, and did not apply to all the flowers. Further, on a plant with white flowers, shoots with yellow flowers were sometimes met with at the same time, or white flowers with 1 or 2 yellow petals, etc.

At first sight, the siliquas of the hybrids appeared intermediate between those of the two parents, both as regards external morphology and anatomy. Closer observation, however, revealed many points of difference and various combinations.

The author studied the *Raphanus* hybrids chemically, both from the point of view of the anthocyanins present in the roots and flowers, and also from that of the carbohydrates occurring in the roots.

R. Raphanistrum has normally only a small amount of sugar in its roots, whereas the starch content is high, being 3 to 4 gm., in 100 gm., of fresh material. *R. sativus*, on the contrary, when cultivated at the same time and under similar conditions, contains sugar, but not much starch. Thus on analysis a pink radish yielded 1.60 gm., of sugar, and 0.60 gm., of starch per 100 gm., of fresh material; the white-tipped pink radish contained 1.30 gm., of sugar, and hardly distinguishable traces of starch. The cross between the pink radish and *R. Raphanistrum* contained 1.90 gm., of sugar and 0.60 gm., of starch (therefore, intermediate conditions exist).

39 - Studies on the Transmission of Characters in Certain Cucurbitaceae Hybrids. —

LOTTY, J. P. in *Genetica*. Vol. II, Part 1, pp. 1-21, 9 fig., 1 plate. The Hague, January, 1920

Cucurbita maxima and *C. Pepo* represent two very distinct Linnaean species which are not capable of reciprocal crossing, as has been proved by the negative results obtained in the author's experiments

Both species produce numerous forms or varieties that are clearly distinguished from one another by a series of fixed and hereditary characters. These forms, which correspond to the small, or elementary, species of JORDAN can, even if they are very dissimilar, be crossed together, giving rise, in the F_2 to complex phenomena that give evidence of the segregation of characters.

CROSSES BETWEEN FORMS OF C. MAXIMA. — For this experiment, two varieties viz., the Turban pumpkin, and " Hubbards' green pumpkin " (1) were used that had the same type of leaves and differed considerably in the shape of the ir fruit.

By crossing Turban Pumpkin ♀ with Hubbards' Green Pumpkin, ♂ 9 plants were obtained in the F_1, and of these only 2 produced fruit by self-fertilisation. These two plants were known as Nos. 12.1, and 12.5 respectively.

The fruits borne by these plants may be regarded as intermediate, both in shape and colour, though they more nearly resembled the fruits of the Turban Pumpkin, than those of " Hubbards Green Pumpkin ".

They are round and rather flat, but the character of " swelling at the extremity " is reduced to a more or less deep incision developed round the extremity; they are reddish, with some white and greenish spots with a single, circular, green zone corresponding to the extremity.

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(1) As the excellent figures and the coloured plate cannot be reproduced here, a short description of the fruits of the two varieties will be useful: —

" Turban pumpkin ": fruit characterised by a swelling (sometimes spherical) situated at the extremity : it has from 4 to 5 sides and is light red with white and green marbling.

" Hubbard's green pumpkin ": fruit badly-shaped, spherical, slightly tapering at both ends, coloured dark green. *Ed.*)

From the seeds of one fruit of the F_1 (12.1 *b*), 45 plants of the F_2 were raised in 1917, and only 3 of these bore fruit. This generation is indicated by the number 7 (7.1, 7.2 ... 7.44, 7.45).

In this second generation, there were a large number of shapes and the most varied shades, which showed the results of the segregation of characters in the hybrids of the two varieties of the *Cucurbita maxima* studied. It is very difficult to determine the genetic factors that come into play, on account of the great fluctuation and variability of the characters, as is seen by the considerable differences existing between fruits borne by the same plant. In any case, however, as far as the red colour is concerned, it is easy to recognise the character of a monohybrid, for out of 45 plants, 33 were red according to the ratio 3 : 1. Red is thus dominant as regards green. None of the fruits were, however, entirely red, there was always some green about them, at least at the extremity. This green patch often extended and crossed the groove surrounding the cap-like top. Touches and patches of green are also met with in the " Turban Pumpkin " ; in the hybrid, these colours are apparently strengthened by the " green Hubbard pumpkin ". As regards the cap of the Turban pumpkin, this character has proved to be liable to great variation, for in the same plant some of the fruits have a well-developed swelling, whereas in others this character is hardly discernable.

Of the 45 plants of the F_2, however, 3 (7.18, 7.21 and 7.27) had completely smooth fruits with no trace of groove or cap This gives the ratio 15 : 1, from which it must be concluded that the groove or cap depends upon the presence of 2 factors or determinants.

The study of the F_3 generation, which the author intends to undertake, will give more information as regards the genetic character of the material. The existence of many determinants, and hence the possibility of very many combinations, can already be deduced by analogy with the combinations obtained with the large number of chromosomes (12), found by M. LUNDEGARDH in the aploide of *Cucurbita Pepo*. With 12 chromosomes, $2^{12} =$ 5096 different gametes are obtained, and $5096 \times 5096 =$ more than 25 million combinations.

From what has been said, it is naturally difficult to obtain new, stable kinds of pumpkin by crossing different varieties of *Cucurbita maxima*.

From the cross Turban pumpkin ♀ × Silver-grey pumpkin ♂ (1), an F_1 was obtained containing individuals of intermediate character with a well defined, though much smaller cap than the ♀ parent. In the F_2, contrary to what occurred in the F_1, the size of the turban instead of being the same, varied within considerable limits. From one plant of the F_2 with a very small cap, fruits with Turbans of all dimensions were obtained in the F_2, some of them being even larger than that of the female parent.

As regards colour, red prodominates over green and all the other colours In the F_2, there were hybrids with red, pink, flesh-coloured, pale yellow, dark yellow, white, dark-red, light-red, grey and other coloured fruits, whereas in the F_1 all the pumpkins were red.

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(1) Flat wheel-shaped fruit of a dark dirty-green colour. (*Ed.*)

Grey predominated in its turn over brown and green. From the seeds of grey fruits obtained by the self-fertilisation of an F_2 plant, 37 plants with brown or green fruits (without trace of red) were obtained in the F_3. This second experiment (Turban pumpkin × Silver grey pumpkin) again proves that the different forms of *Cucurbita maxima* can be crossed, and that they give rise to Mendelian phenomena.

CROSSES BETWEEN DIFFERENT FORMS OF CUCURBITA PEPO. — Crosses were made between " Vegetable Marrow " and " Regenschirm " (Regenschirm = " Patisson " properly so-called = " Artichaut d'Espagne " = " Bonnet d'électeur " = " Arbouse d'Astracan, according to NAUDIN).

" Regenscherm " is a non-climbing plant of bushy habit and is a free-grower; its fruits are flat and yellowish white in colour; seen from above, they look like small open umbrellas (hence the name of the variety). " Vegetable Marrow " a climbing, free-growing plant with cylindrical, yellow fruits.

The hybrids of the F_1 were climbers like the male parent " Vegetable Marrow ", and had elongated, oviform fruits. As regards their colour, 2 of the plants bore dark-yellow fruits, 1 had yellow fruits with orange spots, and the three others had yellow fruits.

In all probability, the specimen of Regenschirm used in the cross was a heterozygote as regards the characters yellowish-white and orange, the first being dominant over the second. The colour of the hybrids of the F_1 with orange fruits, was the result of the combination of the " orange " gamete of Regenschirm with the " yellow " gamete of Vegetable Marrow, whereas the colour of the fruits borne by the other plants resulted from the combination of the " yellowish-white " gamete of Regenschirm and the " " yellow " gamete of Vegetable Marrow. This latter gamete, when present at the same time as the yellowish white gamete gives a more or less, intermediate shade.

The F_2 of an orange fruit of the F_1 was extraordinarily complicated, being of all possible colours, tints, and shades from yellowish-white to orange, and passing through the intermediate shades of bright yellow and dark yellow; from light green to dark green and blackish-green; in addition some fruits were coffee-coloured, a shade that had never been seen before. There was the same variety in the shape of the fruits which were spherical cylindrical, turbaned, apple-shaped, pyriform, etc.; the surface of the fruit might be smooth or wrinkled, of a uniform colour or variegated, spotted, mottled, etc.

Although these characters were subject to great fluctuations, yet we must admit the existence of a rather complicated structure, and of Mendelian phenomena that are far from simple.

By the selfing of an individual of the F_2 (8.12) having fruits of a light brown (*café au lait*) colour, 28 hybrids of similar colour, but of the most varied shaped, were obtained in the F_3. Therefore the plant 8.12 was a homozygote as regards colour, but a heterozygote as regards shape.

An individual of the F_2 (8.20), with pyriform, wrinkled fruits of a dark green colour, produced in the F_3 offspring that were heterogeneous from the point of form and rugosity, but homogeneous from that of colour, all the fruits being orange, either uniform or mixed with green. Here orange is dominant as regards green. As however, all the fruits before becoming orange passed through a green stage, it may be admitted that the female parent would also have assumed as orange tint in time.

From 8.31, a plant of the F_2, with pyriform, flattened fruits, hybrids were obtained with fruits of a uniform orange colour, but also heterogenous as to form.

Finally, from 8.32, a plant of the F_2 with apple-shaped fruits of a dark orange colour, were obtained, in the F_3, hybrids of very varied shapes, but nearly all with orange coloured fruits, there being only a few green or light-brown specimens.

On comparing the data obtained in the F_3 with those referring to the F_2, it appears that, as a rule, the first generation is les polymorphous than the second.

Although it was not possible to determine individually all the genetic factors or determinants implicated, it can, however, be stated with confidence that the different forms of *Cucurbita Pepo*, when crossed amongst themselves, give rise to Mendelian phenomena.

CROSS " ORANJE APPEL (ORANGE PUMPKIN) × VEGETABLE MARROW. — " Oranje-Appel ", according to NAUDIN, would seem to be a variety of *Cucurbita Pepo*, but other writers regard it as another species, *Cucurbita auriantiaca*. It has luxuriant climbing stems, and small fruits of the size of an orange and dark orange in colour.

In effecting reciprocal crosses (Oranje-Appel ♀ × Vegetable Marrow ♂, and Vegetable Marrow ♀ × Oranje-Appel ♂) between these two forms, very different results were obtained in both cases. With Oranje-Appel as the female parent, the fruits were smaller than when Vegetable Marrow was the female parent. This difference also occurs in the F_2; hybrids with Vegetable Marrow as a grandmother bear much larger fruits than those of which the grandmother is Oranje-Appel. There we have a case of transmission from the maternal side (matrocline hydrids).

GENERAL CONCLUSIONS. — (1) The Linnean species *Cucurbita maxima* and *Cucurbita Pepo* are composed of numerous varieties or constant forms (JOURDAIN'S elementary or small species).

(2) The elementary species belonging to the same Linnean species can easily be crossed, and produce fertile hybrids giving in the F_1 many cases of segregation of characters.

(3) Crossing experiments between forms belonging to different species have hitherto given negative results.

(4) Given the large number of experiments, made with negative results, it may fairly be assumed that neither *Cucurbita Pepo*, nor *C. maxima*, can be crossed with *C. melanosperma*; it can also be stated that it is not possible to cross *C. Pepo* with *C. maxima*, although the experiments in this case have been fewer.

(5) Hybrids obtained by crossing *C. Pepo* and *C. aurantiaca* Willd. are fertile and give rise to segregation phenomena, just as if the parents had belonged to two varieties (JOURDANS' species) belonging to the same species. It should however be noted that NAUDIN regards *C. aurantiaca* as a very definite variety of *C Pepo*.

(6) Reciprocal crosses between *C. Pepo* and *C. aurantiaca* show certain differences in the length and other dimensions of their fruits, differences, in every case, of a matroclinal character. Although very improbable, it is not absolutely impossible that this occurrence may be due to the heterozygous nature of the forms crossed, seeing that the characters in question are always transmitted on the maternal side.

(7) In no case was parthenogenesis or apogamy observed.

(8) Some of the forms studied were parthenocarpic.

40 - **The Artificial Production of Vigorous Trees by Hybridisation.** — HENRY, A., in *Quarterly Journal of Forestry*, vol. XIV, no 4, pp. 253-257, bibliography of 6 works. London, Oct. 1920.

For several years the author has been making experiments in the production of new trees by hybridisation, in the hope of obtaining fast-growing kinds that would produce timber rapidly (1). A considerable number of such trees have occurred accidentally, and among them may be mentioned the Lucombe Oak, the Huntingdon Elm, the Black Italian Popolar, the Cricket Bat Willow, and the London Plane. These all show the striking feature of first crosses in the difference of the rate of their growth from that of the parent species. These hybrids of the first generation, in trees as in other plants are remarkable for their size, rapid growth early and free-flowering, the ease with which they can be multiplied, and in all probability their comparative immunity from disease. Impressed with these facts, the author urged in 1910 that the artificial production of trees by crossing was a new and important field of research.

It is a popular belief that fast-grown timber is necessarily soft and comparatively worthless. This is a fact in most conifers; but in one class of broad-leaf trees, the wood of which is characterised by large pores in the inner part of the annual ring, the contrary is true, as the faster the timber of these trees is grown the stronger and denser it becomes. This class includes oak, ash, chestnut, hickory and walnut, the species in fact that, par excellence, produce the most valuable timber.

The difficulty of growing the ordinary species of oak, ash and walnut is the long period required for their maturity, which renders hopeless, except on the best soils, all chance of an adequate financial return. Without vigorous first crosses, the most valuable classes of timber can only be grown in limited quantity.

Immunity from disease might be expected in some, if not all, first crosses. In the case of ordinary species, individuals of great vigour are undoubtedly less liable than weaklings to the attacks of most fungi and are probably less sought after by insects like Chermes and Aphis. In this way, the Dunkeld hybrid Larch (*Larix eurolepis*, A. Henry) may prove immune to Dasyscypha. There is also a possibility of obtaining hybrids, capable of thriving on certain classes of soil, as chalk and peat, on which ordinary kinds of trees cannot be properly grown.

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(1) See *R.* 1915, No. 31 (*Ed.*)

An important question is the propagation of these vigorous crosses once they are created. The first cross does not come true from seed and can only be multiplied by vegetative reproduction. This is easy when the trees are readily propagated by cuttings, as in the case of poplars and willows, or by layers, like the Huntingdon and Belgian elms. We may resort to grafting low on stocks, which should be seedlings of one or other parent.

No explanation has yet been offered in the author's opinion as to the real cause of the extraordinary vigour displayed by hybrids. The vigour is distributed over the whole plant, and is as conspicuous in the roots as in the stem and leaves. What we actually observe is not only an acceleration of, but also an increase of cell-division in all parts of the plant. The cells divide very quickly, continue to divide, and thus build up a taller stem, a more extensive root-system, etc. It is possible that the stimulus which causes growth (i. e ,cell-division) to commence and to continue is some soluble compound or enzyme. Whether the amount of vigour in hybrids is directly associated whith the degree of relationship between the individuals that are crossed is a disputable point, but one of pratical interest in the selection of parents for crossing experiments. One of the author's most vigorous hybrids *Populus generosa*, is derived from two parents so little related that they are placed in two distinct sections of the genus. A cross between two races of the common alder shows considerable vigour, though the parents can only be distinguished by the most trivial characters. The fact, if established, that different races when crossed give vigorous progeny could be turned to practical account in plantations and forests where natural regeneration is looked for. The introduction of a few lines of the Riga variety into a plantation of native Scots Pine might ultimately (as pollination would be effected by the wind), give seedlings of enhanced vigour.

The production of hybrid trees can be undertaken with the best chances of success in southerly stations, where numerous species happen to be cultivated. If hybridisation is tried on a commercial scale, lofty green houses and ladders will be required for the protection and easy handling of the flowers of many species.

Very little has actually been done in hybridisation of forest trees. KLOTZSCH started work in this direction in 1845 at Berlin. He crossed four pairs of species, all common trees (pine, oak, alder and elm), and after eight years the hybrids averaged one-third better than the parents. We next hear of artifiicial hybridisation of trees in California, the most notable being the production of the Royal and Pardox hybrid Walnuts, by BURBANK. The statements currently made in books about these are gross exaggerations; nevertheless, there was considerable increase of growth.

The original Royal Walnut, produced by a cross actually made in 1878, was measured by SHULL in 1907, and found to be 50 ½ ft. in height and 26 inches in diameter breast high. The authors experiments, carried out in 1909-1914, produced several interesting hybrids, the most remarkable being *Populus generosa*. Subsequent experiments in hybridisation carried out at Kew during the war have resulted in the production of numerous seedlings of ash from various crosses that were carefully made, the parent species being *Fraxinus excelsior, F. americana, F. pennsylvania* and *F. oregona*. In no case can one detect the slightest difference between the seedlings and the mother parent, and it seems then as if this is an example of what BATESON calls monolepsis (1). The occurrence of this phenomenon in *Fraxinus* is very embarrassing and would seem at first sight to put a stop to all chance of obtaining true hybrid ash trees. In nature, however, there are cases where hybrids occur, but occur with great rarity, the conditions for their production being unknown. In the case of the ash, the experiments ought to be multiplied and be carried out on a very extensive scale in some place where pollen of numerous species would be available. The author suggests Washington D. C. as the best locality.

The financial advantage of producing a hybrid ash is obvious, but may be simply illustrated as follows. Grant that on a certain soil the common ash attains the requisite size and suitable for felling at 70 years old, and that the hybrid ash, quicker in growth, equals this at 56 years old. Assuming the rate of interest to be 5 per cent which means the doubling of capital in 14 years, it will be readily seen that the hybrid ash in this case is twice as productive as the common ash. The doubling of the value, is an object worth considerable outlay in experiment, and in the author's opinion the artificial production of hybrid trees ought to be taken up seriously and arrangement be made for the establishment of a station for this research either in France or in the United States. This station might be internationalised.

41 - **The Electrification of Seeds by the Wolfryn Process.** — SUTTON, M. H. F., in *Sutton and Sons, Bulletin* No. 11 pp 1-7, Reading 1920 (2).

A series of tests were carried out with seeds of mangold, swede, cattle cabbage and carrot to compare the percentage of germination and the crop values from seed: — 1) Untreated (2 control plots); 2) treated by the WOLFRYN process; 3) immersed in salt solution; 4) immersed in sulphate of ammonia solution; in the two last cases, 4 oz., per gallon solutions and subsequently dried at a temperature of 100°F. The purpose of the experiment was to ascertain if the process is sufficiently beneficial as regards results to justify the expense entailed, and also if the benefit is due only to this process of if equally satisfactory results can be obtained through immersion alone.

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(1) The most notorious example observed by BATESON was as follows: the orchid *Zygopetalum Mackayi* fertilised with pollen of various other orchids (*Odontoglossum* sp., *Lycasta* sp., *Oncidium* sp.), gave purely maternal plants. On the other hand, without pollination no seed is set so that *Z. Mackayi* is not pathogenetic. BATESON states that the conclusion cannot be avoided that fertilisation has acted as a stimulus to development without any admixture of paternal character. — See BATESON, W, *Mendels Principles of Heredity*, p. 248. Cambridge University Press, 1909. (*Ed.*)

(2) See *R.* June, 1919, No. 720. (*Ed*)

Germination Test. — Notwithstanding the one or two points which appeared slightly in favour of the electrified seed, the general results could only be regarded as inconclusive. The mangold seed (electrified) showed the highest germination, but was closely followed by the seed immersed in sulphate of ammonia solution. The untreated seed with carrot and cabbage stood first in the final results

Field Test. — On light loam on a gravelly subsoil; in 1918 dressed with farmyard manure and cropped with lettuces, endives etc; no manure in 1919. In this case also the mangold electrified seed gave the more marked result and a slightly higher yield than any of the other tests.

In no case was the plant from electrified seed observed to appear above ground in advance of the others. With regard to the other crops, reviewing the outdoor tests as a whole the results hardly appeared conclusive, the returns from the electrified seed showing no distinct advantage over the other sections.

42 - **Classification and Detailed Description of Some of the Wheats of Australia.** — *Commonwealth of Australia, Institute of Science and Industry,* Bulletin No. 18, p. 1-48. pl. 5. Melbourne. 1920.

Results of an investigations made concerning the classification of Australian wheats, which were subdivided into 16 classes, each class being distinguished by one of the following points: — bearded or beardless; pubescent or glabrous; dark chaffed or light-chaffed; dark grained or light grained.

Although 16 classes are theoretically possible, actually all the wheats here described are included in the following classes:

1) Bearded, glabrous, light chaffed, light grained.
2) » » dark chaffed, light grained.
9) Beardless, glabrous, light chaffed, light grained.
10) » » light chaffed dark grained.
11) Beardless, glabrous, dark chaffed light grained.
12) » » » » dark grained.
13) » pubescent, light chaffed, light grained

The majority belong to Classes 11 or 12. Each class is in its turn distinguished according to the following botanical and agricultural characters.

I. BOTANICAL CHARACTERS: 1) Solid or hollow straw at the 3rd internode from the head. Any variety in which the majority of the culms in a plant have a diameter of the central cavity less than half the diameter of the straw can be classed as a solid strawed variety; 2) character of awns: a good many wheats possess awns which are longer at the tip than those at the base; in some cases nearly all the spikelets may have short awns which are little more than acute beaks to the glumes and these are termed tip awned; 3) character of head: either clubbed, square or tapering. In the first case, the head, is broader and more dense at the tip than at the base ; in the second almost an equal breadth from tip to base and third; narrower at the tip ; 4) density of ear (number of spikelets per 100 mm. of rachis) three possible degrees of density can be recognised: *a*) dense type with any thing over 25 ; *b*) medium dense type 20 to 25 ; *c*) open type under 20 ; 5) spikelets: These vary in size and appearance, some being compact with the florets tightly packed together and the outer glumes pressed against the outer florets, while in others the rachilla to which the florets are attacked is elongated, causing the florets to spread and open out, and the whole spikelet to become fan shaped. The spikelets in the majority of Australian wheats can be described as medium spreading ; 6) number of grains per spikelet : the greatest number found is 7, but the usual number is from 4 to 5 while some varieties seldom have more than 2 or 3 ; 7) outer glumes : in some cases the keel is broad at the tip and practically disappears at the base while in others it is small, but is even throughout the entire length of the glume : the apex of the glumes varies from long to short, straight to curved, blunt to acute ; the presence or absence of a lateral point on the shoulder, which marks the termination of a large vein is usually characteristic for a variety : The following types of outer glume are found : — *a*) Keel even, bleak blunt no lateral point *e. g.* Federation ; *b*) keel even, beak long, distinct lateral point, *e. g.* Dart's Imperial ; *c*) keel broad at tip, beak long, blunt, slight lateral point, *e. g.* Roseworthy ; *d*) keel broad at tip, beak long acute, *e. g.* Bearded Gluyas; *d*) keel even, marked, beak small, distinct lateral point, *e. g.* Huguenot — 8) Grain. — Colour, size, shape and hardness are all susceptible to great variation, dependent to a certain extent on the season. Grains rich in gluten are translucent, whereas those rich in starch content are opaque ; a wet season will cause almost any grain to be opaque, the slow ripening inducing a large formation of starch, while rapid ripening in a dry, warm season produces a flinty, translucent appearance. Two distinct types of colour can be recognised : dark or red grained and light-grained. As to size, the smallest grain measured on an average 6.5 or 7 to 8 mm. The general shape is constant: blunt at both ends and square in outline ; length and breadth much the same ; long, narrow and pointed ; usually oval.

AGRICULTURAL CHARACTERS : — *Stooling property.* — Meteorological conditions have a considerable effect on stooling. This is evident according to the results obtained at Longerenong Agricultural College with the same varieties of wheat during the two seasons of 1912 and 1914. In 1912 the plants were above ground by the end of June and the rainfall was heavy up till the end of August ; while in 1914 there was less rainfall at seeding time and during the early stages of development. Some of the variations in stooling properties are as follows

	1912	1914
Federation	21	8
Firbank	18	11
Thew	16	9
Kubanka	21	9
Yandilla King	11	6
Huguenot	5	4

These figures show that it is useless to do more than describe a variety as a poor, medium or prolific stooler.

Season. — The division into early, mid season, and late wheats is based on the time of ripening of the ear. But although it is certainly a constant feature in a district with a fairly equable climate, such as is found in Victoria, this does not hold throughout the Commonwealth, with its widely varying climates. Wheat in a district with winter rain and a warm dry spring will tend to ripen much earlier than in a district with a cold dry winter and spring rains. In the first case the, varieties tend to ripen at much the same time, whereas in the second there will be more than a month's difference between the earliest and the latest varieties. This can also be seen in the same district in two different seasons.

These fluctuations are, however, considerably reduced, if the length of time elapsing between germination and full bloom is taken into consideration.

The following are some of the results obtained at the Roseworthy Agricultural Experiment Station, 1906-1908:

	Number of days between germination and ripening
Early varieties	179
Mid-season	198
Late	206

with a maximum difference of 27 days.

	Number of days between germination and blooming
Early varieties	132
Mid-season varieties	150
Late varieties	171

With a maximum difference of 39 days. The data collected by Prof. PERKINS of Adelaide are therefore confirmed as regards the advisability of taking into account the date of time of earing rather than the time of ripening before classifying as early or late. Although the time of heading is not in any case more than 14 days at the most, the variation in the time of ripening may be as much as 70 days. It has not, however, been possible as yet to collect lists from the different States as to the time of heading and the seasons here mentioned refer to the time of ripening.

Character of Early Growth. — Erect stems — as they appear above ground, develop vertically; this in striking contrast to the spreading type in which the stems lie horizontally. Between these 2 extremes, 2 intermediate types may be distinguished.

The following list includes the most important varieties grown in Australia divided up into classes and types according to the definite botanical characters and the more variable agricultural characters:

CLASS I. — *Type* 1: Bearded, glabrous, light chaffed and light-grained. *King's White.*
CLASS II. — *Type* 2: Bearded. glabrous, light chaffed, dark grained: *King's Red.*
CLASS III. — *Type* 3: Bearded, glabrous, dark chaffed, light grained: *Bearded Gluyas.*

CLASS IV. — Beardless, glabrous, light chaffed, light grained.

Type 4 : Head slightly clubbed, tip awned, straw hollow or slightly pithy, grain large : *Currawa, Penny, Dart's Imperial, Clubhead.*

Type 5 : Head square or very slightly clubbed, sometimes tapering, tip awned, straw hollow or slightly pithy, grain large. *Major, Wallace, Purple Straw.*

Type 6 : Head slightly tapering, tip awned, straw hollow or very slightly pithy, grain large : *Steinwedel. Roseworthy, Yandilla King, Farmer's Friend, Baroota Wonder, Bunyip.*

Type 7 : Head tapering, tip awned, straw hollow or slightly pithy, grain small : *Queen Fan.*

Type 8 : Head tapering, tip awned, straw hollow but with slight pith, grain large : *Triumph, Majestic, Genoa, Florence.*

Type 9 : Head tapering, tip awned, straw hollow, pithy, grain large : *Marshall's No.* 3, *Rymer, Firbank, Caliph.*

Type 10 : Head tapering, bald, straw very pithy almost solid, grain large : *Warren.*

Type 11 : Head tapering, bald, straw hollow, grain large : *New Zealand.*

Type 12 : Head tapering, bald, straw hollow, grain small : *Comeback Jonathan, Bobs.*

CLASS V. — Beardless, glabrous, light chaffed, dark grained.

Type 13 : Head tapering, tip-awned, straw hollow but pithy, grain small : *Marquis.*

Type 14 : Head tapering, bald, straw hollow, grain large : *Warden.*

Type 15 : Head tapering, bald, straw hollow, but slightly pithy, grain small. *Cedar.*

CLASS VI. — Beardless, glabrous, dark, chaffed, light grained.

Type 16 : Head square, almost clubbed, tip awned, straw hollow, grain large : *Bayah.*

Type 17 : Head slightly tapering, tip awned, straw solid, grain large : *Gluyas, Canberra.*

Type 18 : Head slightly tapering, bald, straw hollow, grain medium. *Federation, Hard Federation.*

Type 19 : Head tapering, slender, tip awned, straw hollow, grain large : *John Brown.*

Type 20 : Head tapering, bald, straw hollow, but pithy, grain small : *College Eclipse.*

CLASS VII. — Beardless, glabrous, dark chaffed, dark grained :

Type 21 : *American* 5.

CLASS VIII — Beard less, pubescent, light chaffed, light grained.

Type 22 : *Jumbock.*

All these wheat varieties are common and *Federation* only represents 75% of the total production. Durum wheats are far less common, these are :—

CLASS I. — *Type* 1 : Bearded, glabrous, light chaffed, light grained : *Kubanka.*
CLASS II. — *Type* 2 : Bearded glabrous, dark chaffed, dark grained : *Medeah.*
CLASS III. — *Type* 3 : Beardless, glabrous, dark chaffed. light grained : *Huguenot.*

The author gives a detailed description of each variety accompanied by plates and figures. The following are the data relative to the origin of each variety :

1) *King's White*? Selection by Roseworthy Agricultural College from Joseph King's King's Early.
2) *King's Red* : Selection by Roseworthy Agricultural College from Joseph King's King's Early.
3) *Bearded Gluyas* : Appeared as a sport in Roseworthy Agricultural College, Gluyas selection plots.

4) *Currawa* Hybrid obtained by H. Pye by the following crosses:

Northern Champion × Cretan
Little Club × Unnamed
Currawa

5) Penny: Slection from Squarehead, produced by Penny, Green Hills, Western Australia.
6) Dart's Imperial: Selection from an unknown variety produced by T. Dart of Nhill.
7) Clubhead: (= California Club, Oregon, Chili, Little Club): imported from the United States
8) Major: Federation × Wallace Bred by H. Pye of Dookie.
9) Wallace: Purple Straw × Fife Indian Bred by H Pye.
10) Purple Straw: Unknown.
11) Steinwedel: Selection from Champlain's Hybrid of Dalkey, South Australia in 1886.
12) Yandilla King: Yandilla × Silver King. Bred by R. Marshall of South Australia.
113) Roseworthy: Received by Roseworthy Agricultural College from Farrar in 1902 as Jonathan. It was grown there for some time, but in 1913 it was found to be quite different from the original Jonathan, and it was therefore renamed Roseworthy.
The hybrid Jonathan was apparently sent in an unfixed condition.
14) Farmer's Friend: Selection from Purple Straw, by John Johns, of Katandra, Victoria.
15) Baroota Wonder: Selection probably from Ward's Prolific by G. Crittenden, Telowie, South Australia.
16) Bunyip: obtained by the following Crosses.

Blount's Lambrigg × Hornblende
Purple Straw × Improved Fife King's Jubilee × Unnamed
Rymer × Maffra
Bunyip

17) Queen Fan: Fan × Carmichael's Eclipse Cross-bred produced at Roseworthy Agricultural College.
18) Triumph: Silver King × Rangit. Bred R. Marshall, South Australia.
19) Majestic: election from Ward's Prolific by R. Marshall.
20) Genoa.

White Naples × Improved Fife.
White Naples × Unnamed Improved Fife × Eden
Unnamed × Unnamed
Genoa

Bred by W. Farrer.

21) Florence.

White Naples × Improved Fife
Unnamed × White Naples Improved Fife × Eden
Unnamed × Unnamed
Florence

Bred by W. Farrer.

22) Marshall's No. 3 Bred by R. Marshall, of South Australia.
23) Rymer: Improved Fife × Purple Straw. Bred by W. Farrer.
24) Firbank.

$$\underbrace{\underbrace{\underbrace{\text{Blounts Lambrig} \times \text{Horneblende}}_{\text{Unnamed}} \times \text{King's Jubilee}}_{\text{Zealand}} \times \text{Maffra}}_{\text{Firbank}}$$

Bred by W. FARRER.

25) Caliph: Marshalls No 3 × King's White Crossbred produced at Roseworthy Agricultural College.

26) Warren:

$$\underbrace{\underbrace{\text{Bobs} \times \text{Jonathan}}_{\text{Unnamed}} \times \text{Warner}}_{\text{Warren}}$$

Bred by W. FARRER.

27) Thew:

$$\underbrace{\text{Selection from Blount's Lambrigg} \times \underbrace{\underbrace{\text{Sinew} \times \text{Improved Fife}}_{\text{Unnamed}} \times \underbrace{\text{Improved Fife} \times \text{Hussar}}_{\text{Unnamed}}}_{\text{Unnamed}}}_{\text{Thew.}}$$

28) Zealand (= Berthoud): Imported from France by G BERTHOUD

29) Comeback.

$$\underbrace{\text{Improved Fife} \times \underbrace{\underbrace{\text{Hornblende} \times \text{Indian } A}_{\text{Varessa}} \times \text{Indian } G}_{\text{Unnamed}}}_{\text{Comeback}}$$

Bred by W. FARRER

30) Jonathan

$$\underbrace{\underbrace{\text{Fife} \times \text{Hussar}}_{\text{Unnamed}} \times \text{Indian } G}_{\text{Jonathan}}$$

Bred by W. FARRER.

31) Bobs: Cross between Nepal barley and Early Lambrigg. Bred by W. FARRLR.

32) Marquis: Cross between Red Fife and an Indian Wheat, Calcutta Hard Red. Originated in Canada.

33) Warden.

$$\underbrace{\underbrace{\text{Quartz} \times \text{Ward's White}}_{\text{Unnamed}} \times \text{Red Bordeaux}}_{\text{Warden.}}$$

Bred by H. PYE.

34) Cedar

Jonathan × Zaft (Indian)
Unnamed × Power's Fife Manitoba)
Unnamed × Power's Fife
Cedar

35) Bayah

Improved Fife × Lambrigg Australian (Manitoba var) Talavera
Jonathan × Unnamed
Bayah

Bred by W. FARRER.

36) Gluyas : Selection from Ward's Wheat by Messrs. GLUYAS of Telowie, South Australia.

37) Canberra : Cross between Federation and Volga barley. Produced at Wagga, New South Wales, by R. HURST under instructions from W. FARRER.

38) Hard Federation : Selection from Federation, by J. T. PRIDHAM of South Australia.

39) Federation :

Improved Fife × Etawah
Yandilla × Purple Straw
Federation

Bred by W FARRER.

40) John Brown.

Ble carre × Wards White
Improved Fife × Unnamed
Hornblende × Unnamed
Unnamed × Lambrigg's Australian Talavera
John Brown

Bred by W. FARRER

41) College Eclipse : Selection from Carmichaels Eclipse, made at Roseworthy College.

42) American 8 : Imported from America.

43) Jumbuck :

Fife × Tardent's Blue
Unnamed × Australian Talavera
Jumbuck.

Bred by W. FARRER.

DURUM WHEATS

44) Kubanka (= Belotourka) : Obtained from Kazan Kerghiz Steppes, Russia.

45) Medeah : obtained from M. VILMORIN, Paris.

46) Huguenot : produced by A. CORRELL, of South Australia, selection from Medeah.

43 - **The Wheats at the Paris Seed-Testing Station.** — SCHRIBAUX, in the *Journal d'Agriculture pratique*, Year LXXXIV, No. 35, pp. 176-177. Paris, August 26, 1920.

In the experiment field of the Paris seed Testing Station, 4 varieties of wheat attracted special attention in 1919-1910. These were as follows:

(1) *South Tunisian Touzelle*. Ears 12 days before the Provence Tonzelle, is more resistant to lodging, and quite as productive. Does werll in South France, Tunisia, Algeria, and Morocco.

(2) *Carlotta Strampelli* (1). Grain of good quality, less resistant to rust than Rieti, but is more productive than the latter. Resists lodging. Can compare with some of the best northern varieties,

(3) and (4) *Vuiteboeuf* and *Bretonnieres* (2). Early productive, grain of good quality, very resistant to cold.

44 - **The New "Peace Hybrid Wheat".** — GANDOT, G in the *Journal d'Agriculture pratique*, Year 84, No 1, p. 298, 1 fig Paris, October 7, 1920

Messis VILMORIN-ANDRIEUX have just put on the market a new wheat the "ble hybride de la paix", obtained by crosses effected by P. DE VILMORIN.

This new hybrid is a descendant of the "blé hybride hâtif inversable" (early non-lodging hybrid wheat). Its other ancestors are Bordeuax wheat and one of the old Vilmorin hybrids. Its height is that of the "early non-lodging variety; its straw is stiff and strong, and glaucous before maturity. The ear is large, dense, red, and nearly square. The grain is large, yellow, and of clearly superior quality to that of the early "non-lodging hybrid".

This new wheat has been tested in several farms in the Paris district, where its yield has been roughly equal to what of the "early non-lodging hybrid". It belongs to the series of alternative wheats. When sown in autumn it is slightly later than the "early non-lodging". In the spring it can be sown up to the middle of March and grows very well under these conditions.

45 - **Early Varieties of Wheat and Oats.** — SÉVERIN, R., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 25, p. 640. Paris, July 7, 1920.

With the idea of completing, in the order of ripening, the series of early wheats that are rust-resistant in the climate of the Gironde, the author presented to the Académie, after Pusa N°. 4, Hindi, and Pereal Toti, type ears of 3 varieties of the same order and suitable to arid soils of average fertility and to the rudimentary methods of dry-farming, as these wheats can grow with as little as 300-350 mm. of rain. These wheats are of average productiveness and are adapted to producing early crops, for they ripen earlier than rye and all the native wheats (semi-winter), or to extra-late spring-sowing, when the crop ripens at the same time as autumn wheats. They can also be grown in summer, in order to compensate for any deficiencies in the normal harvests by a new autumn crop. They are as follows: —

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(1) See *R.*, Feb., 1915, No. 167; *R*, Nov., 1916, No. 1175; *R.*, Jan., 1918 No. 35. (*Ed.*)

(2) See *R.*, Nov-Dec., No. 1090. (*Ed.*)

(1) Awnless "Cedar wheat," of Hindoo origin, selected by the Agricultural Station of Berkeley, California. Its straw is short, fine, flexible, resistant to lodging, and the red, glutinous, grain is characterised by a dorsal furrow.

(2) Awned "Propo" wheat, of very vigorous growth, strong tillering and regular yield. Its narrow leaves, fine flexible straw that bends under the weight of the ears, all contribute to form the pendent tufts that characterise its habit The grain is whitish, and gives a lemon flower much prized for fancy-baking and pastry-making.

(3) Chinese wheat (introduced by VERSIN of Orleans in 1918) has an awned, cylindrical ear, which is short and blunt, and packed with coloured grain emerging from the glumes; the grain is dry and semi-glutinous This variety is characterised by such a capacity for tillering that it may be said to bear two crops a year.

The author subsequently presented 2 samples of awnless, SCHRIBAUX Ligowo × Brie oats (1) .The Ligowo × Brie oat cultivated in Gironde has no awns, as has been found on growing it is summer and spring for two years. He also showed the "Liberty" variety of oat, which was obtained by Prof. SAUNDERS (Cerealist of the Dominion of Canada). It is awnless, which makes it much in request by the oatmeal industry, and, in addition, very early.

46 - **Relative Yields from Broken and Entire Kernels of Seed Maize.** — BROWN, E B, in the *Journal of American Society of Agronomy* Vol 12, Nos 6-7, pp. 196-197 Washington, C. Sept-Oct, 1920

Investigations were carried out in 1914 to discover whether injuries of a physical nature to kernels of seed maize affects the growth, development, and productivity of the plant. Broken or cracked kernels from each ear were planted in comparison with uninjured kernels from the same ear. The breaking was similar to the injuries that frequently occur in mechanical shelling and seeding. The injuries were confined to the endosperm, in no instance extending to the germ.

The following shows a comparison between the relative yields obtained:

Class	Adult plants	Ears produced	Total weight of ears	Ears per plant	Average weight of ears	Yield per plant	Yield per acre
					lb	lb	bus
Broken seed .	57	57	36 5	1 000	640	640	64 0
Entire seed .	78	77	55.4	988	616	716	71 1
Difference . . .	—	—	—	—	—	—	7.6

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(1) See *R*, May, 1920, No 507. (*Ed*)

Based on 7 000 plants per acre and 70 lb., of ears to the bushels.

The field germination from the broken seed was less than from the entire seed, and the seedlings were weaker. The general height of plants at maturity did not materially differ. In number of ears per plant the increase in number of ears from the broken seed was associated with the increased space per plant resulting from the poorer stands. The weight of ear and yield per plant was consistently less than that from the entire seed.

In practical maize growing the losses in yield per acre from broken seed would be much less and frequently negligible, but the tendency would be the same.

47 - **Cultivation and Uses of Buckwheat in the United States.** — LEIGHTY, E (Agronomist in Charge of Eastern Wheat Investigations), in the *United States Department of Agriculture, Farmers' Bulletin,* 1062, pp 3-24, figs. 6. Washington, D. C, Oct., 1919.

A detailed account is given of the climatic requirements, soils most suitable, the general cultivation from sowing to harvesting, the thrashing methods employed and the yields. Buckwheat is grown principally in the north-eastern part of the United States, more than 60 % of the crop being produced in New York and Pennsylvania. The area production and farm value (1) 1904-1908, inclusive is shown as follows .

Year	Acre	Average yield per acre	Production	Average value per acre
Annual average	acres	bushels	bushels	dollars
1904–1908.	789 000	18.86	14 880 000	12.32
1909–1913.	843 000	19.71	16 616 000	13.73
1914–1918.	870 000	17.76	15 360 000	20.61

The legal weight per bushel is 48 lb., in the States where most of the crop is produced, but varies according to the different States.

This crop has been found to succeed well on acid soils, and on poor land. It serves to make even very hard land mellow and friable. Consequently it is a good crop to use in preparation for such crops as potatoes etc. It does best where the climate is cool and moist.

Uses. — It is estimated by the United States Department of Agriculture that on an average, 7 bushels (48 lb. each) yield 1 barrel (196 lb.) of flour, *i. e.* a yield of 58 $^1/_3$ %. Buckwheat more than one year old is reported to make flour inferior to that made from new grain. The grain contains in each 100 lb., 10.8 lb. crude protein (about the same as maize), 72.5 lb. carbohydrates, and 2.5 lb. fat.

The whole grain is a source of food and feed and it makes a good poultry feed. The straw is also sometimes used and is more readily eaten by the stock if well preserved.

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(1) See *R.*, March 1917, Nos. 215 and 258. (*Ed.*)

Further uses of buckwheat are enumerated as follows: — weed destroyer, green manure and soil renovator, e. g. sowing with rye has been found advantageous, an orchard cover; a honey plant.

48 - **Hairy-Vetch Seed Production in the United States.** — KEPHART, L. W. (Scientific Assistant) and MACKEE, R. (Assistant Agrologist, Office of Forage Crops Investigations). in *U S Department of Agriculture, Bulletin*, No 876, 32 p, figs 7 Washington, D. C, September 1, 1920

"Hairy vetch," also termed "Russian vetch," "sand vetch" and "winter vetch" (*Vicia villosa*) is a hardy winter-annual legume, with wide adaptations to an unusual variety of conditions and uses. It thrives in nearly all soils and climates and is probably more widely distributed than any other leguminous forage crop except sweet clover. It is grown for hay, pasturage, soiling, green manure, a cover crop, silage and seed. The plant is especially noteworthy for its ability to grow on poor soil, for its resistance to cold, drought, and alkali; and for its comparative immunity from insects and diseases. There qualities have led especially to the use of the plant for building up poor soils and as a substitute for red clover, alfalfa, and the grasses in regions where these crops do not flourish. Hairy vetch has thus come to be considered as essentially a poor-land crop. It is equally valuable on richer soils, however, and can be used to advantage in any system of farming where a winter-growing forage crop is desired.

The consumption of hairy vetch seed in the United States increased about twenty-fold in the 5-year period from 1908 to 1913, and the crop is now grown in some part of nearly every State. Nevertheless, hairy vetch has not met with the general popularity that its good qualities would seem to warrant.

A common objection to hairy vetch is that the plant is a weak-stemmed vine which is unable to stand upright withont support. Unless accompanied by a companion crop to which it can cling, it is apt to lodge badly and to make a heavy tangled masswh ich is difficult to plough under or to harvest But the high cost of seed has been the greatest handicap to its more extended use.

In the past, large quantities of hairy-vetch seed have been imported in the United States (4 547 824 lb., in 1913), but in more recent years this quantity has been greatly reduced (256 500 lb., in 1919). The reduction in imports resulting in the high price of seed, has lent interest to home production.

Michigan has been the principal centre for the production of hairy-vetch seed, but seed production has proved successful in practically all localities where the crop can be grown.

Hairy vetch is adapted to a wide range of soil types, but it does best on rich sandy loams.

The crop can be seeded, harvested, and thrashed with ordinary farm machinery with but little or no modification.

The seed of hairy vetch is difficult to separate from the small grains with ordinary seed separators, but the spiral separators now used in many localities have proved successfull.

Diseases and Insect Pests. — Until quite recently hairy vetch was considered almost immune from the attacks of fungous diseases and insects. But little work has been done in the matter of identifying and determining methods of control for the diseases of hairy vetch. A leaf spot disease (*Mycosphaerella pinodes*) attacks the leaves of hairy vetch quite frequently and does some damage. Another disease (*Protocoronospora nigricans*) which attacks the stems, leaves and pods, has done considerable damage to hairy vetch and has been especially serious the past few years in the South Atlantic States. No control measures have been worked out for either disease.

One of the few insects that injure hairy vetch to any extent is the pea aphis (*Macrosiphum pisi*), which attacks the plants during the blossoming period and sucks the juices from the stems and leaves just as the seeds are setting. In wet seasons and in heavy rank growth the aphids sometimes appear in great numbers and almost destroy the vines before their presence is suspected. Fortunately, aphids cause much less damage in the thin, open stands which are the most profitable for seed production. The injury from aphids is most likely to occur on heavy soils where the crop is grown for hay. No practical means of control is known.

In the cotton belt, especially along the Atlantic coast, hairy vetch occasionally is injured seriously by the common cotton bolloworm (*Chloridea obsoleta*). The invasions of this insect, when taken in time, are easily combated. They are most likely to occur during the spring months before the other host plants of the insects are available for food. Where the cotton bollworm attacks hairy vetch, the most useful remedy is to apply the following mixture as a spray at the earliest possible moment viz powdered arseniate of lead 1 lb. + water 50 gal. Where this poison is used at the strength specified, there is comparatively little danger of poisoning cattle. It is advisable, however, not to pasture vetch that has been sprayed with this mixture until after heavy rains have occurred.

49 – **Lespedeza as a Forage Crop.** — Carrier, L. (Agronomist, Office of Forage Crop-Investigations) in *Farmers' Bulletin*, 1143. *United States Department of Agriculture*, pp. 3-15 figs. 5 Washington, D. C, Aug 1920.

Lespedeza striata, commonly known as "Japan Clover" is one of the most valuable forage crops for the southeastern part of the United States. Its widespread adaptation to grazing conditions gives it an extraordinary value and will grow in open woodlands, on the forest of upland hills, along roadsides and in other waste places. Although an annual plant, sufficient seed is produced even under close grazing to reseed itself. As a legume, this crop has been found valuable for soil improvement, and is also relished by all classes of livestock. Results show that good hay is produced on alluvial bottom lands, and wherever sufficient growth is made for cutting for thus purpose, lespedeza is recommended for use in crop rotations. A 3-year rotation of maize, oats and lespedeza is advised in preference to only oats and lespedeza. The last is often allowed to stand a fourth year, and cow peas should be planted in the maize as the last crop. Wherever this system is followed, there is a marked increase in yield as for example, in Mississippi and Louisiana.

Oats may be harvested and a crop of lespedeza either for hay or seed grown on the same land in one season.

The chief use recommended is as a constituent in permanent pastures of Bermuda grass (*Capriola dactylon*) and carpet grass (*Axonopus compressus*) An abundance of moisture is required for maximum growth, but good drainage is essential, as the plants will not succeed on wet land.

Details are given by the author with regard to the history, distribution and cultivation, and use in meadow mixtures.

50 - **Perennial Ryegrass and Wild White Clover.** — GILCHRIST, Prof., in *The Journal of the Ministry of Agriculture*, Vol. XXVII, No. 7, pp 671-677. London, Oct 1920

A lecture emphasising three important points in grassland improvement: (1) The benefits following the inclusion of wild white clover (*Trifolium album*) in seed mixtures; (2) the value of perennial rye grass and the proper method of retaining and devoloping this grass; (3) the improvement of turf which results from proper treatment of grass

I. — After many years experience the mixture used for three-year leys on poor clay with excellent results was as follows:— 16 lb., perennial rye grass, 10 lb., cocks foot (*Dactylis glomerata*), 4 lb., timothy (*Phleum pratense*) 4 lb., late flowering red clover, 1 lb., trefoil and 1 ½ lb., wild white clover per acre The rotation was a six course one and since 1912, five of the 3-year leys were reported as producing in the first, second and third years, 42 cwt., 45 cwt., and 38 cwt., per acre respectively. The unusual results were said to be due to the inclusion of the white clover.

The clover aftermaths were found most valuable for grazing and inconsistently good condition, and the turf at the end of the 3 years was always excellent.

On poor stiff clay soil of low value an addition of 4 lb., wild white clover gave an average crop of hay for eleven years of 34 cwt., per acre compared with 23 ½ cwt., without this addition.

With, regard to the treatment of the leys, a good seed bed is advocated as being of the greatest importance. The only manure used throughout the whole experiment was 10 cwt., per acre of basic slag. This was applied to the young seeds as soon as possible after the barley crop was harvested on the 3-year leys, and every third year on the above mentioned poorer soil.

The inclusion of late flowering red clover in the mixture was due to clover sickness to which the ordinary red clover is more readily addicted.

II. — The lecturer explains that previous failure with perennial ryegrass was due largely to the absence of close grazing and heavy treading by stock. Several instances are quoted showing that by paying due attention to these two points. the more nutritious will be the pasture and the more numerous the head of grazing stock which it will carry.

To illustrate the improvement of turf which follows the treatments outlined, specimens indicated that: (1) Unmanured turf consisted mainly of poor wiry bent fescue grasses, stunted and starved wild white clover plants, and 2 inches of dead organic matter, and underneath an apparently worthless soil; (2) treated with basic slag and closely grazed with cattle showed instead an abundance of perennial ryegrass and other good grasses, and a luxuriant growth of wild white clover. The subsoil was a good sandy loam, dark in colour with rich organic matter and moisture.

51 - **Effect of Mole Tunnelling on the Flora of the Pastures of Cantal.** — URBAIN, A. J. and MARTY, P., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 13, pp. 581-583. Paris, Sept. 27, 1920.

The unmown meadows of Cantal (Auvergne, France), particularly those in the higher districts are covered with mole-hills, which are soon over-run with abundant vegetation. The authors have made a special study of the flora of these mole-hills and have followed up its development.

The following Table gives the species found during the first first two years of research on mole-hills in a damp meadow in the neighbourhood of Aurillac: -

FIRST YEAR.

Usual meadow plants.	*Ranunculus acris* L., *Ranunculus bulbosus* L., *Trifolium repens* L.. *Hieracium Pilosella* L., *Rumex Acetosella* L., *Juncus effusus* L.
Plants not habitually present. .	*Lotus corniculatus* L., *Trifolium pratense* L., *Cirsium acaule* All. (rare), *Cichorium Intybus* (rare), *Veronica serpyllifolia* L., *Ajuga reptans* L.

SECOND YEAR.

Usual meadows plants	*Ranunculus acris* L, *R. bulbosus* L., *R. Flammula* (rare), *Trifolium repens* L, *T. montanum* L. (rare), *Potentilla verna* L., *Achillea Millefolium* L., *Taraxacum Dens-Leonis* L., *Hieracium Pilosella* L., *Gentiana Pneumonanthe* L. (rare), *Myosotis palustris* With (rare), *Rumex Acetosella* L., *Juncus effusus* L., *Luzula campestris* D. C., *Carex vulgaris* Fries, *Nardus stricta* L., *Anthoxanthum odoratum* L. (rare), *Phleum pratense* L., *Poa pratensis* L., *P. trivialis* L., *Agrostis alba* L.
Habitually present.	*Polygola vulgaris* L., *Lotus corniculatus* L., *Trifolium pratense* L., *Vicia Orobus* D. C. (rare), *Potentilla reptans* L., *Galium verum* L. (rare), *Cirsium acaule* All. (rare), *Calluna vulgaris* Salisb., *Plantago lanceolata* L., *Holcus lanatus* L., *Polytrichum commune* L.

The effect of the network of mole-tunnels is:—

(1) To drain the soil.

(2) To carry out a kind of ploughing and harrowing at many points on a level with the mole-hills, thanks to which the natural meadow seeds,

as well as those brought by wind and birds, can germinate easily and fight successfully against the encroaching native vegetation.

(3) To introduce new plants, sometimes good fodder types, such as *Lotus corniculatus* L., *Trifolium pratense* L., *Holcus lanatus* L., etc.

52 – **Cotton in South-West Madagascar.** — JUMELLE, H., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 32, pp 784-788. Paris, Nov. 3, 1920.

Some fifteen years ago cotton cultivation in north-west Madagascar gave some hopes of success, but now it is in a very neglected condition.

It is a long time since the cotton-plant grew in a semi-wild state in many parts of the island, in the centre, north-west and south, and the natives have cultivated it for a very long time.

From the climatic point of view, taking the animal rainfall, as a basis, the zone where cotton is grown comprises $^4/_5$ of the total area of the island i. e., the western, north-eastern towards Antalaha, and the High Plateaux regions, but, owing to soil conditions the area of importance as regards the crops is much reduced and part of the centre in particular appears to have been eliminated.

Damage due to insects and other pests have discouraged those who first took up cotton growing, so much so that it will not be easy to urge that the former attempts be renewed.

In case the opinions should be modified or where it appears the right moment to start experimenting again, neglecting the American varieties, for example, as being too delicate, and replacing them with more robust types such as the improved forms of species long since acclimatised to the island, and if the industry will accept these cottons, it will be useful to know which are these types which have remained.

Judging from specimens sent by M. PERRIER DE LA BÂTHIE to the author, and which he considers as corresponding to the type that grows wild at the present time, but has never been cultivated in any of western villages this "native" Madagascar cotton is *Gossypium purpurescens*. The designation "native" is used because it was introduced into Madagascar and naturalised a long while ago. It is not unlikely that *G. taitense*, might be found as frequently, as this species is so closely allied to the aforementioned type that they might be confused one with another, when their distinctive characteristics are not property known; in every case, the author's specimens are certainly closer to *G. purpurescens* than to *G. taitense*.

The Mahafaly natives in south-west Madagascar cultivate a cotton which is also occasionaly semi-wild and is very close to *G. obtusifolium* ("cottonier de Bourbon", or "de Porto-Rico"), It has short hairs $^3/_4$ to 1 inch in length, and is very resistant to drought and the attacks of Rhynchota. *G. obtusifolium* comprises the Indian *Wightiana* variety, widely cultivated in India under the name of Gujarat cotton and classified as long staple; this is popular.

The author concludes that there is probably little reason for paying much attention to the Madagascar "native" cotton (*G. purpurescens*), but states that if and when the experiments are revived, it would be advisable not to attempt to improve the Mahafaly but rather to see what could be done with plants from seeds of the related Guyarat variety, which, although it has more or less degenerated owing to bad cultivation, is apparently the best suited to certain regions of west Madagascar.

53 - **The Seeds of "Sang Mau Bung" (*Horsphieldia Irya* Warb).** — VERNET, G. and NGUYEN-VAN-LONG, in the *Bulletin agricole de l'Institut Scientifique de Saigon*, Year II, No. 10, pp. 297-299 Saigon, Oct., 1920.

The Sang Mau Bung " tree (*Horsphieldia Irya* Warb, Fam. Myristicaceae) is fairly common in Cochin-China. The bark contains a red tanniferous latex which is used by the natives for throat troubles.

From the fresh grain BUSSY, using a hydraulic press, extracted an oleo-resin. Nothing was obtained by the authors from the ripe, dried grain when pressed, either hot or cold. When treated, with 90° alcohol, a resin was easily extracted which was quite suitable for making varnish. In making varnishes, 30 % of resin is dissolved in denatured 90° alcohol. When giving a first coat to wood, the varnish can be diluted with an equal volume of alcohol. After application with a brush and drying, the surface is very brilliant, but further coats must not be given till the previous one is dry.

As its melting point is somewhat low (120°C.), the varnish must not be exposed to higher temperature, as it loses its brilliance and becomes dull.

It is insoluble in water and MAGEN has used it for varnishing leather as it is sufficiently supple not to crack when the leather is bent in certain ways.

54 - **Change-Over Tappings of Hevea in Cochin-China.** — GIRARD, E., in the *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VII, No 10, pp. 336-338 + 1 photo. Antwerp, Oct., 1920.

All sectors of the Suzannah and An-Loc plantations which have been tapped alternately have amply confirmed the results of the first experiments (1).

The alternations of tapping varied from one day in two to 1 ½ months in 3. The highest yields were always obtained, up to a certain limit, with the longer periods of consecutive tapping and rests. From the data obtained, the author has deduced, at least provisorily and applied to all the plantations the following rules for alternation: —

The first cut, 27.5 inches from the ground, should embrace $^1/_3$ of the girth. If tapping is made 6 days a week for one month in two the strip of bark should last at least 2 years and most probably 30 months. This allows over 6 or 7 years before it becomes necessary to work on the newly formed bark which undoubtedly forms more quickly and completely with alternate tapping. Under these conditions, each worker taps two parts in alternate months which corresponds, for each tree, allowing for Sundays and holidays, etc., when no work is done, to about 23 days of tapping out of 60 days, there being 37 days (30 consecutive) of rest for the trees. The system was applied first in August, 1919, and in December, 1919, the author found, for 26 days of tapping, an increase in yield of 85 % over the corresponding production in December 1918, for 31 days when the same plots were tapped daily. Full confirmation of this was obtained in August, 1920, a year after the inception of the system. The author points out the advantages that would result from the general adoption of the system.

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(1) See *R.*, Jan., 1920, No 50, and *R.*, Sept, 1920, No. 980. (*Ed.*)

The application of the alternation of periods, which the author believes is necessary for the conservation of the rubber plantations (for its has been proved that daily tapping rapidly exhausts the trees), appears to correspond to a reduction of 30 to 40 % of the total crop during the first year. This decrease, however, is noticeable chiefly during the first few months. The result is to make the market less congested and after a very short time brings about a rise in prices.

Taking into account the large area of the plantation that has been tapped intensively for several years, two years must be allowed before full production is again reached after monthly alternation has been put into practice. This is a sufficient length of time for all the rubber produced by the plantations to be completely absorbed by the market.

55 - **Natural Coagulation of Hevea Latex in a Closed Vessel after the Addition of Calcium Salts.** — SPOON, W., in the *Mededeelingen van het Central Rubberstation*, No. 21. Buitenzorg, May, 1920. Translated into French by BRIANT, J., in the *Bulletin agricole de l'Institut Scientifique de Saigon*, Year II, No 10, pp. 308-310. Saigon, Oct. 1920.

In this work, the author gives detailed information on the acceleration of the natural coagulation of hevea latex by soluble calcium salts. He states that from 0.05 to 0.10 % (or 0.02 to 0.04 % of lime) of calcium chloride ($CaCl_2$) will bring about complete coagulation in a closed vessel in 24 hours.

WHITBY, CAMPBELL, and BARROWCLIFF think that this accelerating effect is due to an increase in the activity of the coagulant enzymes, but EATON is of the opinion that the action is purely chemical. VERNET (1) suggests that calcium salts have a coagulative effect on the latex proteins and thus lead to the coagulation of the latex.

The author also examined the influence of the winter on coagulation. During the dry season of 1919, the loss of leaves on the trees in the Experimental Garden at Buitenzorg was very pronounced and began at the beginning July of just before winter was over, i. e., at the end of August; the trees had already produced new leaves. The author found that in May and June the coagulation, always practically complete in 20 hours, was strong and the serum clear; during July, there was a change however, and coagulation remained very incomplete until the end of August. In September, it was completed within 20 hours.

As regards the trees in question, and the two cuts given on ¼ of the girth, it appears that a relation exists between winter and natural coagulation in the absence of air.

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oct, 1920, No. 979. (*Ed.*).

It is possible, by employing special methods, to obtain complete and spontaneous coagulation within about 24 hours, by adding 0.2 % of sugar and keeping the mixture at a temperature of 40°C. (1) for 7 or 8 hours In the tests descibed here $CaCl_2$, was used. These agents give excellent results with latex during the wintry weather, in July and August, a period when spontaneous coagulation is incomplete. It is sometimes necessary to increase the quantity of sugar by 2 to 3 gm. per litre or the $CaCl_2$ by 0.5 to 1 gm. per litre of latex.

Some authors consider that calcium salts used in small quantities, are absorbed by the coagulum and may affect the rubber, but the authors experiments seem to show that the occlusion of $CaCl_2$ has no harmful effect on the rubber.

More rapid vulcanisation is obtained with rubber coagulated with calcium salts than with acetic acid, but the uniformity in the typical time of vulcanisation of crêpe treated with calcium salts is not as good as that of other naturally coagulated crêpes.

56 - **Influence of Large Cuts on the Chemical Composition of Hevea Latex.** — ARISZ, H. (after researches by SCHULTZ VAN VLISSINGEN, L. R. E. (Chemist at the Experimental Station of Besoeki), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 10, pp. 311-312. Saïgon, Oct., 1920.

The following observations were made on the results of heavy circular cuts reaching the wood:—

(1) Independantly of the rubber content of the latex, the relation between the resinous matter and the rubber does not change.

(2) During the first fortnight, the concentration of organic substances in the serum does not change; after that it diminishes (2).

(3) The nitrogen content of the latex remains steady during the first few days and then decreases by one half. This loss is slightly greater than that of rubber; calculated on the percentage of rubber as well as on the latex; a decrease in the nitrogenous substances is evident in both cases.

(4) The concentration of the organic substances in the serum (more diluted and probably absorbed by the rubber) remains practically constant.

57 - **" Chicle " and the Exploitation of the "Zapote" (*Sapota Achra*) in Mexico.** — Communication from the National Office of Foreign Commerce (Office national du Commerce exterieur), in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year V, 1920-1921, No. 33, pp. 73-79. Paris, September, 1920.

The product sold under the name of " chicle " consists of a gum extracted from " chico zapote " (*Sapota Achras*, Fam. *Sapotaceae*), a tropical tree which attains the height of 20 to 25 m., and a girth at the height of a man of from 2.50 to 3 m.

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(1) See *R.*, Oct., 1920, No. 979. (*Ed.*)

(2) This was first reported in the *Bulletin économique de l'Indochine* in 1905, No 44, p. 720, in an article entitled L'*Hevea brasiliensis*, sa culture et son exploitation dans Sud-Annam by M. G. VERNET. (Note by the Editor of the *Bull Agr. de l'Institut Scient. de Saïgon*).

The rugged cortex of *S. Achras*, when between 30 and 40 years of age, is 4 to 5 cm., thick. In Mexico, the flowering season lasts from March to May, and the fruit ripens from May to the end of September.

Hitherto, chicle has only been used for chewing, a common habit in the United States, and widely diffused in Europe since the war.

The wood of *S. Achras*, reddish or dark rose-coloured, and very hard, is used as timber, in carriage-building, and ship-bulding.

The tree thrives on the clayey, very damp soils of the coast, and does specially well on flat, low-lying ground. It also grows satisfactorily on calcareous soils.

The latex (chicle) is secreted by laticiferous cells, in which it occurs in the form of small whitish drops. These cells are situated in the part of the cortex nearest to the sap-wood. The latex flows through intercellular canals. The parts of the tree yielding most latex are the trunk, principal branches, and the secondary branches.

For a *Sapota* to yield the maximum amount of gum, it must, be growing on flat ground with a southern exposure, and in the neighbourhood of a stream or of a large body of water. It also requires a very heavy rainfall of long duration. The cold rains brought by the north winds prolong the season of gum-collecting so that it lasts to February or March, which is a great boon to the industry.

In Mexico (Yucatan), the latex is collected as soon as the tree has attained a girth of 80 cm., at 1.50 m., from the ground. The extraction begins with the first rains of the season, i. e., in July or August

A description is given of the implements used for obtaining the latex and preparing the gum. A man slowly ascends the trunk making, as he goes, a slanting incision with his " machete " from below upwards. At the lower end of the cut, he places a leaf to direct the latex, into a vessel at the foot of the tree. A clever " chiclero " can tap as many as 15 to 20 trees daily.

As soon as a sufficient amount of latex is obtained, it is stirred quickly with a stick, and then placed on the fire in small copper or iron pots. The latex must be constantly stirred to prevent it adhering to the sides of the pots and burning and to induce the evaporation of the water it contains. After having been sufficiently cooked, it is removed from the fire and allowed to cool before making it into blocks, by pouring it into wooden moulds that have been first placed in soapy water to prevent the gum from sticking to them. As soon as the gum is sufficiently cool, it is turned out of the moulds. The blocks thus made, weigh from 11 to 12 kg. The chicle gum is then sent to the ports to be shipped abroad, where it is refined, and placed on the market under the names of " pepsin gum ", " chewing gum ", " sen-sen gum ", etc.

58 - **The Cultivation and Distillation of Peppermint in Piedmont.** — MICHELETTI, C., in the *Bollettino dell'Associazione italiana Pro piante medicinali, aromatiche, ed altre utili*, Year III, No. 9, pp. 132-135. Milan, September, 1920.

Peppermint is grown in Piedmont in the neighbourhood of Turin and Cunéo over an area of some 600 hectares; it also occupies a few hectares in other parts of Italy. The crop is gathered and distilled during the first three weeks of August.

The essential oil of Italian-grown peppermint is superior to that of all others as regards mildness and perfume, but the supply is far too small to satisfy the home demand, let alone foreign markets. The author therefore urges that this plant should be more extensively grown in Italy.

Peppermint does very well as the first of a rotation of crops; it is not an exacting plant, and provided that the climate is sufficiently damp it can defy bad weather, and even storms, owing to the rapidity with which it produces new shoots and flowers. It flourishes in flat strong marly loams especially if rich in organic matter. One hectare yields from 175 to 200 quintals of fresh plants n normal years, and as much as 250 quintals in exceptionally favourable seasons.

In 1920, the plants fetched 30 *lire* per quintal, which meant a net profit of 100 % to the grower. From 120 000 quintals of green plants from Piedmont, from 25 000 to 27 000 kg., of essential oil was obtained (it takes about 4 quintals of plants to produce 1 kg., of essential oil). This was sold in 1920 at 250 *lire* per kg., which gave a large profit to the distillers.

The distillation of mint is carried out in the following manner: From 3 to 4 quintals of freshly-cut plants are placed in the still and pressed down well. Then the still is filled about two-thirds full with water, and the whole contents boiled for two hours, either over an open fire or else (which is better) by the direct or indirect steam. The only fuel used is wood. The essential oil that condenses in the worm of the still at the same time as the steam, subsequently flows into a Florence flask. The water, when separated from the essential oil, passes back into the still. In 24 hours, 10 to 11 distillations are effected with each still.

This industry which began in the most modest manner about fifty years ago, received a great impetus from H. CARLES, who introduced into Piedmont the cultivation of the English Mitcham peppermint which contains much more essential oil than the Italian variety.

59 - **The Prickly Pear in Australia.** — ALEXANDER, W. B. (Science Abstractor). *Institute of Science and Industry, Bulletin* No. 12, pp. 5-48. Melbourne, 1919 (1).

In Australia, the prickly pear is utilised for the following purposes: —

HUMAN NOURISHMENT. — The only species notified as being utilised for human nourishment in other countries are: *Opuntia Ficus-indica, O. decumana, O. streptacantha.*

LIVESTOCK FEED (2). — The pest pear (*O. inermis*) possesses a considerable value as a reserve feed in times of drought. But 4 trial feeding tests with cattle, milch cows, calves, and sheep have led to the following conclusions: —

(1) The forage should be well prepared before giving to the stock. It can be chopped up either by hand or by machine and fed in troughs,

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(1) See *R.* Nov.-Dec. 1920, No. 1916.

(2) See *R.* March 1915, No. 299; Nov. 1915, No 1180; Feb 1917, No. 169. (*Ed.*)

or still better, roasted or heated in boiling water; this last method is the best.

(2) None of the above mentioned animals are much attracted to *O. inermis*; its chief utility consists therefore, in its employment as reserve forage in times of drought.

(3) A supplementary protein feed, such as flax cake, or maize forage, lucerne hay or soya is absolutely necessary.

(4) The addition of appreciable quantities of prickly pear to the daily rations for milch cows, lowers the percentage of fat in the milk and the quantity of butter produced, but increases to a certain extent the milk production. The milk is suitable for the manufacture of cheese. For milch cows, it is advisable to employ prickly pear as a part feed only.

5) *O. inermis* may be fed to breeding stock, provided that an additional quantity of protein feed is also given. The same thing applies to calves, in times of drought.

6) For ewes not giving milk, the ration should contain coarse straw; this feed is not suitable for breeding ewes and lambs.

7) Cattle fed on *O. inermis*, should be grazed on shrubby pasture land or where vegetation rich in protein content is avaitable.

8) During hot weather, the livestock fed on prickly pear is constantly in need of water.

GREEN MANURE. — That supplied by *Opuntia* enriches the soil in potash and organic matter (1). In Ceylon, India, South Africa, Mediterranean Coast, and occasionally in Australia, successful results have been obtained.

In 1913, CAMPBELL, analysed the by-products of *Opuntia* obtained by dry distillation, i. e. in a distillate. The percentage content was as follows:— Water 88.4; acids (determined as acetic acid) 0.154; ammonia, amines (primary and secondary (determined also as ammonia 0.005; tertiary amines (determined as pyridine); Residue, 4 % of crude tar and 4 % carbon.

In Australia the utilisation of the fruits of the prickly pear in the production of alcohol, and the fibres as first quality material for the manufacture of paper and cardboard, has not proved successful from the economic standpoint.

60 - **Cultivation of the Artichoke in the Roman Maremma, Italy.** — LAZI, A. in *La Nuova Agricoltura del Lazio*, Year VIII, No. 188, p. 123. Rome, Nov. 1, 1920.

VARIETIES AND CULTIVATED. — According to the author the best cultivated varieties are the Tuscan Violet or " nostrale ", the Empoli, artichoke, Venitian artichoke, and the large Roman artichoke.

CULTIVATION. — The artichoke needs a temperate climate, as frosts harms it very much, consequently, when digging over the ground in autumn or winter the plants should be earthed up well. The plant grows well in strong clay loams, and even better in open marly clay soils.

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(1) See *R.* Nov. 1915, No. 1131. (*Ed.*)

The land is prepared at the beginning of autumn, when it is dug to a depth of 50 to 60 cm., after being well manured (about 800 quintals of manure per hectare). In October and November, after the land has been well prepared, the artichokes are planted 6 to 8 cm., deep. and 1 m., apart, leaving 1 m., between the rows. In the spring the soil is earthed up round the young plants with a wooden plough or hoe.

ANNUAL ATTENTIONS. — Land producing artichokes should receive a dressing of decayed manure in autumn, followed by digging in. The shoots which grow on the mother plant should be removed leaving only the strongest and best developed ones. Instead of good farmyard manure a fertiliser composed of 80 gm., mineral superphosphate + 20 gm. potassium sulphate + 20 gm., ammonium sulphate may be used per plant.

In March, hoeing and removal of the leaves is commenced. Four or five of the biggest leaves are taken from each plant and used as green fodder, but they must be given in moderate amounts to milking cows. The removal of the leaves continues until the beginning of May.

COST OF CULTIVATION. — At the present time, in certain parts of the Roman Maremma, a well-kept artichoke farm will bring in a yearly protfit of 11 000 lire for 10 or 12 years. A debit and credit account is summarised in the following Table (per hectare).

COST OF CULTIVATION.

	Lire
Digging at 50 cm., 250 days at 20 *lire*	5 000
Hoeing: 25 days at 15 *lire*	375
Manure: 80 cub. m. at 6 *lire* per cub. m.	320
Transport of manure: 10 *lire* per cub. m	800
Plantation: 7 days at 15 *lire*	105
Plants: 10 *lire* per thousand	100
Rent of land	270
Total	6 970
Interest at 5 % on capital	348
Total	**7 318**

Account when other plants (potatoes, beans, peas etc.) are cultivated with the artichoke.

	Lire
Cost of Cultivation	7 318
Plantation of potatoes: 10 days at 15 *lire*	150
Potato seed: 10 cwt. at 75 *lire*	750
	8 218

RECEIPTS.

	Lire
Potatoes: 100 quintals at 50 *lire*	5 000
800 dozen artichokes	2 000
Leaves	500
	7 500

Deficit at end of first year 8 218 *lire* — 7 500 — 718 *lire*.

Expenses :

AVERAGE EXPENSES AND RECEIPTS FOR 10 YEARS

	Lire
Digging: 64 days at 20 *lire*	1 280
Hoeing: 25 days at 15 *lire*	375
Manure : 80 m° à 4 *lire* per cu. m	320
Transport of manure a 10 *lire* per cu. m.	800
Land rent	270
Debt repayment	71
Total . . .	**3 116**

Receipts :

	Lire
Sale of artichokes at 1 *lira* per plant	10 000
Sale of 4 crops of leaves: 800 quintals at 5 lire per cwt	4 000
Young plants: 7 000 at 10 *lire* per thousand	700
Gross receipts . . .	14 700
Expenses . . .	3 116
Net profit	**11 084**

PESTS. — The field mouse causes great damage by eating the collar of the plant, Zinc phosphide is a good preventive. During wet seasons, plant lice (*Aphis cardui*) attack the plant, but can be controlled by an ordinary soap solution. The leaves are attacked but not much harmed by the larvae of *Vanessa cardui*. Among the fungoid diseases mention should be made of *Peronospora gangliformis* Berk (= *Bremia Lactucae* Regel), which produces a kind of silvery mould on the under side of the leaves, attacking the calathides and causing rot. Spraying with a solution of borax or with milk of lime is effective.

61 - Chinese Tuberous Mustard *Sinapis juncea* var. *napiformis*. — DE NOTER, R., in *Le Jardin*, Year XXXIV, No. 743, pp. 157-158 + 1 fig. Paris, Oct. 20, 1920.

The author states that this exotic legume, which is eaten in winter is very hardy, for it withstood well the winter of 1917; it yields a first-class product.

The comestible part is the napiform root, which is about 15 cm., long and 5 to 6 cm., in diameter.

The soil should be well dug, light and have received abundance of fertilisers. The seed is sown in rows, 30 cm., apart, from the beginning of August, and watered frequently; when the plants have 3 or 4 leaves, they are thinned out to about 15 cm., apart.

They are gathered in 2 or 3 months. This mustard which is barely piquant in taste, will keep in a cellar or in a hog until April but can also be left in the ground and gathered when required.

62 - Apple Orchard Pruning Experiments in Vineland, Canada. — PALMER, R. F., in *The Agricultural Gazette of Canada,* Vol. 7, No. 9, pp. 754-755. Ottawa, Sept., 1920.

An experiment consisting of a comparative test of three different pruning treatments namely:— (*a*) Winter or dormant pruning; (*b*) summer pruning; (*c*) no pruning. About 15 different varieties were under observation.

Results showed that the heavy dormant pruned group made much less growth than either the unpruned or summer pruned trees and came much later into bearing and with a much smaller yields. It was evident that the lighter the pruning the greater was the growth the earlier the tree came into bearing, and the heavier the yield during at least the early period of the trees life. Unpruned trees made more growth than either of the other two systems, but in consideration of the increased cost of spraying, picking, growing lack of colour, and general undesirable condition of unchecked growth, light annual pruning is advised until the tree comes into bearing. After this, more severe pruning may be necessary to maintain a proper supply of new wood each year. This will of course vary with the variety.

63 - The Problem of Re-Afforestation in Spain. — *Real Sociedad Española de los Amigos del Arbol, Boletin Oficial de la Sociedad,* Year X, No. 102, pp. 1-5. Madrid, 1920.

General conclusions presented to the Spanish Government by the Eighth Section of the National Congress of Spanish Engineers. After enumerating the advantages that would accrue to the nation from re-afforestation, the report deals with timber production, forest management, the transport of forest products, mountain pastures, resin production, materials for the paper industry, cork, dry distillation of wood, the forest wealth of the Gulf of Guinea Colony, and river fisheries.

Timber production is now a matter of great economic importance, and as it is of special national interest, it is necessary to consider how the output can be improved, both as regards quantity and quality.

To increase the quantity, the management of the forests should be entrusted to the Public Services, and all schemes of management should be directed towards obtaining, within a short space of time, the best and highest yield, and of founding in forest regions, many trial Stations for native and exotic trees. In order to improve the condition of the stands, the forests, commencing with the most important, should be provided with easy and economic clearing tracks. The administrations should fix the price of trees sold to private individuals, according to the quality of the wood and the purpose for which it is to be employed. The physical and mechanical properties of the products should be studied experimentally, especially at the Central Technical Forestry Experiment Institute, which possesses all the means necessary for carrying out technical sylvicultural experiments. The formation of a State Forestry Reserve is also necessary for this purpose.

As regards the management of the forests, the Congress is of opinion that the regulations in force need immediate revision, and that an economic method must be substituted for the ordinary system of forestry ;

hitherto in existence. As regards transport, the report states that as making clearing tracks must be regarded as work of public utility, special legislation should be passed, inviting forest owners to contribute to the expenses of making the roads. It is equally important to give a strong impetus to the construction of secondary railroads, cart roads and district roads in the forest regions that are now at a great distance from the centres of consumption.

Further, given the great importance of the livestock industry, it is necessary to improve the pasturage on waste land, steppes, and other parts of Spain where the ground cannot be turned to better account. The forest zone must be divided into regions and sections, special study being devoted to the conditions of vegetation and the pastoral industry Experiment fields should therefore be made, the pastures improved, the seeds of suitable and selected forage crops produced and, in short, all this work should be co-ordinated, and publications issued dealing with these matters. In addition, the local Services should deal with questions of hygiene, the provision of drinking-troughs, and the construction of shelters for stock and shepherds.

With regard to the resin industry, the report states that the present system of collection should be altered, and that in the case of *Pinus Pinaster*, the Forestry Experiment Station should study some means by which both the wood and the resin of this tree could be used.

The conclusions of the Congress as to the paper industry are that is necessary to study the zones most suitable for the production of the raw material required; to create communication roads in the Pyrenean zone, where the pine and birch can be utilised, to intensify and extend the cultivation of esparto grass in the Mediterranean districts; to establish nurseries and distribute gratuitously rapidly-growing seeds and forest trees.

It is to the interest of the country that all the native cork should be worked up in Spain; therefore the tax of 5 *pesetas* per quintal on exports of sheet cork should be removed while, at the same time, the importation of all qualities of cork should be prohibited. The report also recommends the inception of experiments on the effect of potash upon cork production, both from the point of view of quantity and quality.

In order to assist the wood-distillation industry, the Congress proposes that the import duty on acetate of lime should be raised to 50 *pesetas* per quintal; that the entrance into Spain of methylated alcohol should be prevented by raising the import duty to at least 160 *pesetas* per hectolitre; and finally, that the railways should offer reduced tariffs for the transport of pyroligneous liquids, acetate of lime and especially for the charcoal produced by distillation. The competent Ministry is also requested to estimate quickly the approximate annual volume of the wood intended for distillation, and to include in the data all matters connected with this industry, such as the cost of wood and of labour, costs of transport, the most important markets for wood charcoal, etc. The report also states that it is necessary to draw up, without delay, schemes for the management of forests containing wood suitable for dry distillation, and able to furnish at least 1 000 to 1 500 metric tons of wood per annum.

The report also deals with the forest wealth of the Spanish Colony of the Gulf of Guinea, in so far as it recommends the nomination of a technical Commission for the study of the forests there, and the separation of the agricultural zone from the forest zone together with the creation of a Forest Service in the Colony for the purpose of directing forestry operations in such a manner that Spain may obtain the greatest advantage.

As regards the river fisheries of Spain, the report mainly deals with the conventions made with border States, and the means of promoting fresh-water fishing, which could produce an annual return of 79 million *pesetas*.

64 - **A Policy of Forestry for the Nation in the United States.** — GRAVES, H. S. (Forester, U S. Forest Service). — *United States Department of Agriculture, Circular 148, Office of the Secretary*, pp. 11. Washington, D. C., 1919.

A national policy of forestry seeks the protection and beneficial utilisation of the present forest resources, the renewal after cutting of forests on lands not needed for agriculture and settlement, the stability of forest industries and of satisfactory conditions for forest workers and the restoration of forest growth on lands now unproductive and idle.

The public interests in the continuance of forests justify and require direct public ownership of extensive areas, and also participation of the public in working out the problem of protection and renewal of private forests. A programme of forestry for the Nation should include action by the public through the United States Government and each State; action by landowners and operators, and the means of uniting the efforts of all for the achievement of a common purpose.

The States have not only the function of handling the public forests owned by them, but they have also a direct responsability in the protection and continuance of private forests. In this, the Federal Government should take part to meet interstate and national problems, to stimulate action by the States and to bring into harmony the efforts of the different States. A national policy must recognize also the problems of the private owners of forests. A programme in which the public participates and recognises industrial problems, such as taxation, would enable private proprietors to handle their forests in a way that would result not in a public injury but in making these forest serve in building up the localities in which they are situated.

PUBLIC FORESTS. — There should be an extensive programme of public forests, owned by the Nation, by the States, by municipalities, and too, by quasi-public institutions and organizations. The public forests in the United States to-day comprise about 25 per cent. of the total forest area of the country. They should be extended to include ultimately from 40 to 50 per cent.

PRIVATE FORESTS. — The safeguarding of private forests is possible through an organized system of protection, through the prohibition of destructive processes, and through the promotion of constructive measures of forestry. The participation, liberal cooperation and direction of the public in working out the problems involved are necessary for success. Besides protection against fire insects and disease, the renewal of forests on lands not needed for agriculture is an essential feature of a national policy of forestry. The first steps in this undertaking are to determine in each region:

1. The circumstances under which fire protection alone will not suffice to prevent wastage of the land under prevailing methods of lumbering;
2. The additional measures necessary to secure conditions favorable for natural renewal;
3. The classes of land upon which forest growth should be continued;
4. The co operation that should be given by the public to make feasible in practice the measures that may be necessary for the owners to take;
5. The legislation needed to bring these measures into practice, as a part of the State's programme of forestry.

Every encouragement should be afforded to bring about close utilisation of timber in the forest and to prevent losses in the handling and use of the manufactured product. This will be acomplished largely through co-operation and research. in bringing information to the knowledge of operators and users of wood products. It is a problem of investigation and industrial education, in which the public should take the leadership.

ASSISTANCE AND CO-OPERATION ON THE PUBLIC. — In a national policy of forestry the public itself should assume certain responsibilities and certain burdens. It should co-operate with and assist private owners in carrying out their part of the undertaking The measures of co-operation fall under the following heads:

1. *Fire protection.* — The public should directly share the burden of fire protection, especially in a preventive system and in the cost of suppression.

2. *Assistance in forestry* — The public should assist owners in working out plans for cutting that will promote natural reproduction, in planting, and in other measures of forestry. The State should offer planting stock at cost and co-operate with the owners in establishing plantations.

3. *Forest loans.* — It has been suggested that existing legislation concerning farm loans should be extended to include loans for the purchase and improvement of forest lands, to encourage the holding of lands previously acquired, where the purpose of the owner is to hold and protect cut-over lands or those having growing timber, to reforest lands by seeding or planting, or to use other measures in promoting forest production. To obtain the benefit of such loans, which should be for a maximum period of 50 years, the land owner should enter into a specific obligation to retain the land in growing timber and protect and care for it during the duration of the loan.

5. *A survey of forest resources.* — Funds should be provided whereby the Federal Government in co-operation with States and private interests may make a survey of the forest resources of the country.

6. *Land classification.* — The public should co-operate in land classification to aid owners to put their lands to the most productive use.

7. *Research work.* — Adequate funds should be provided to enable the Government and other public agencies to carry on investigation work needed in carrying out a national policy

of forestry. This would included investigations on a large scale for determining the best methods of forest practice, and also research in forest products.

8. *Forest insurance.* — As soon as forest property becomes secure under systematic protection, fire insurance comes within the range of feasibility. Every encouragement should be given to plans of insurance such as that already inaugurated in the north-east.

A programme for the nation must be an aggregate of local programmes adapted to différent conditions, and correlated and standardised through the U. S. Federal Government to meet the broader requirements of the whole country. A national programme can not put into effect in its entirety at once. Local programmes will also probably have to be worked out by steps. Some States are already able to go forward more rapidly than others, partly because of ther financial strength and partly because experience has already demonstrated the methods of protection and forestry required to secure results on this ground.

The initiation of a national policy of forestry requires as one of the first steps the passage of a federal law that recognizes its objectives and provides the Government with authority and means to extend co-operation with the States in protecting and perpetuating the forests under their jurisdiction along the lines of the foregoing statement. At the same time federal appropriations for the purchase of forest lands should be greatly increased.

65 - **New Trees Obtained by Hybridisation, Fast Growing Kinds and Hence Early Supply of Timber.** — See, No. 40 of this *Review*.

66 - **The Cork Industry of Spain in 1919.** — BORRALLO, J. A., in the *España Forestal*, Year VI, No 58, pp. 107-109 Madrid, July, 1920.

In 1919, the yield of cork was 80 million kg., valued at 9.20 *pesetas* per kg., but in 1916 it was 70 million kg. and sold at 9.36 *pesetas* per kg. The total value realised in 1919 was 15 899 966 *pesetas*, an increase of 1 656 549 *pesetas* over 1916. The chief centres of production were the provinces of Cadiz, Huelva Badajoz, Caceres, Malaga, Seville, and Cordova.

The cork industry, which suffered very much during the war,largely because the best workers emigrated to America, had recovered by the end of 1919 owing to the increase in foreign orders

The following Table gives the Spanish imports and exports of cork in 1919 in kg. :—

Imports.

	Kg.
Algeria	399 098
France	209 116
Morocco	27 232
Portugal	1 084 706

Total . . 1 720 152 valued at 461 442 *pesetas*, plus 13 216 kg., of manufactured cork valued at 28 677 *pesetas*.

Exportation.

Country	Raw cork kg.	Cork in pieces kg.	Stoppers kg.	Other forms kg.	Parings kg
Austria-Hungary	—	—	27 803	—	—
Argentina. . .	—	299 298	184 171	—	—
Belgium . . .	7 100	—	—	—	—
Brazil	—	—	28 860	—	—
Chile.	—	—	57 447	—	—
Cuba.	—	—	121 576	—	—
France . . .	151 180	272 748	4 058 300	1 151 276	1 868 747
Germany. . .	25 710	—	33 066	—	—
United Kingd.	4 270	—	238 953	269 651	5 809 056
Italy	—	236 163	99 987	—	—
Portugal . . .	—	—	41 024	—	15 966
U S. A. . . .	1 122 920	10 188	304 682	1 789 999	24 623 175
Other Countries	416 979	184 574	601 884	162 607	1 717 509
Total . . .	**1 728 160**	**1 002 971**	**5 797 753**	**3 890 122**	**34 034 453**
Value in *pesetas*	777 672	2 758 170	2 898 876	2 024 120	3 403 445

The grand total is 46,453,459 kg., valued at 37 952 172 *pesetas*.

LIVESTOCK AND BREEDING

67 – **Principal Poisonous Plants in Canada.** — Flyes, M.lle F. (Assistant Botanist) in *Dominion of Canada, Department of Agriculture, Dominion Experiment Farms, Bulletin* No. 39, pp 1-112. + 40 pl. Ottawa 1920.

This Bulletin, in addition to the numerous illustrations given by the author, describes in detail the various species, and it is compiled with the intention of presenting the farmer and plant breeder with a means of identifying the poisonous plants which are to be found in the meadows and pastures. The symptoms evinced by poisoning from these plants are described, and the methods of treatment indicated. A bibliography of 24 works und a list of species is included in the appendix.

The species examined were as follows:

Hypocreaceae: — Rye "ergot". (*Sclerotium Clavus* Fries = *Claviceps purpurea* Tul.

Polypodiaceae: Bracken (*Pteris aquilina* L. = *Pteridium aquilinum* (L) Kuhn).

Equisetaceae: Common or Field Horse-Tail (*Equisetum arvense* L.).

Gramineae: "Darnel" (*Lolium temulentum*) — Cause of splitting: — Awns and seed of Porcupine Grass (*Stipa spartea* Trin.) and of Needle grass (*S. comata* Trin. and Aupr.) — Sanbur thorns (*Cenchrus tribuloides* L.) — Silk fibres of *Setaria* spp. — Seeds of Squirrel tail grass or wild barley (*Hordeum jubatum* L.) — Wild oats (*Avena fatua* L).

ARACEAE: Jack in the pulpit (*Arum triphyllum* (L.) Torr.) — Green dragon (*Arisaema Dracontium* (L.) Schott) — Arrow arum (*Peltrandra virginica* (L.) Kunth) — Water arum (*Calla palustris*) — Skunk cabbage (*Symplocarpus foetidus* (L.) Nutt) = *Spathyema foetida* (L.) Raff.) — Western skunk cabbage (*Lysichiton camtschatcense*. Schott).

LILIACEAE: Zygadenus or death camas (*Zygadenus venenosus* Rydb.) = *Toxicoscordium gramineum* Rydb.) — Smooth camas (*Zygadenus chloranthus* Rich. = *Anticlea elegans* (Pursh) Rybd.) — False hellebore (*Veratrum viride* Ait).

IRIDACEAE: " Blue flag " (*Iris versicolor* L.).

URTICACEAE: "Slender nettle» (*Urtica graciles* Act.) and other stinging nettles.

PHYTOLACCACEAE: " Poison poke " (*Phytolacca decandra* L.; *P. Americana* L.). .

CARYOPHYLLACEAE. — Purple cockle (*Agrostemma Githago* L); Soapwort (*Saponaria officinalis* L.); Cow cockle or cowherb (*Saponaria Vaccaria* L. = *Vaccaria Vaccaria* Britton).

RANUNCULACEAE. — Cursed crowfoot (*Ranunculus scleratus* L.); Tall buttercup (*R. acris* L.); *R. abortivus* (*R. reptans* L.); Pasque flower (*Anemone patens* L. var. *Wolfgangiana* (Bess) Kock = *Pulsatilla patens* (L.) Mill.); marsh marigold (*Caltha palustris* L.) The species suspected are :— Yellow marsh marigold (*C. asarifolia* D. C.); Mountain marsh marigold (*C. leptosepala* D. C.); Dwarf marsh marigold (*C. Chelidonii* Greene), Larkspurs (*Delphinium* spp.); White baneberry (*Actaea alba* (L.) Mill.); Red baneberry (*A. rubra* [Ait] Willd.); Western red baneberry (*A. arguta* Nutt.).

MENISPERMACEAE: Canada moonseed (*Menispermum canadense* L.).

BERBERIDACEAE: " Blue cohosh " (*Caulophyllum thalictroides* (L.) Mich); May apple (*Podophyllum peltatum* L.).

PAPAVERACEAE: " Bloodroot (*Sanguinaria canadensis* L.); Celandine (*Chelidonium majus* L.).

LEGUMINOSAE: Lupins (*Lupinus* spp.); Locoweed (*Oxytropis Lamberti* Pursh).

EUPHORBIACEAE: " Sun spurge " (*Euphorbia helioscopia* L. = *Tithymalus helioscopia* (L.) Hill); Cypress spurge (*Euphorbia cyparissias* L. = *Tithymalus cyparissias* (L.) Hill).

ANACARDIACEAE: Poison ivy (*Rhus Toxicodendron* L. = *Toxicodendron Toxicodendron* (L.) Brit); Poison sumac (*Rhus Vernix* L. = *Toxicodendron Vernix* (L.) Kuntze.

THYMELEACEAE; Wicopy. (*Dirca palustris* L.) Mezereon (*Daphne Mezereum* L.).

UMBELLIFERAE; Poison hemlock (*Conium maculatum*); Water hemlock (*Cicuta maculata* L.); Bulbous water hemlock (*C bulbifera L.*); Water parsnip (*Sium cicutaefolium* Schrank).

Ericaceae "Mountain laurel" (*Kalmia latifolia* L.) Sheep laurel (*Kalmia angustifolia* L.).

Apocynaceae; Spreading dogbane (*Apocynum androsaemifolium* L.); Black Indian hemp (*A. cannabinum* L.).

Asclepiadaceae "Butterfly weed" (*Asclepius tuberosa* L.); Swamp milkweed (*A incarnata* L.); Common milkweed (*A. syriaca* L.); Showy milkweed (*A. speciosa*); Oval leafed milkweed (*A. ovalifolia*).

Solanaceae "Bittersweet" (*Solanum Dulcamara* L.); Three flowered nightshade (*S. Triflorum* Nutt.); Common nightshade; (*S. nigrum*) L.); Black henbane (*Hyosycamus niger* L.); Thorn apple (*Datura Stramonium* L.); Purple thorn apple (*Datura Tatula* L.) *D. Metel* L.).

Lobeliaceae "Indian tobacco (*Lobelia inflata* L.); Great lobelia (*L. syphilitica* L.); Cardinal flower (*L. cardinalis* L.).

Compositae "While snakeroot" (*Eupatorium ageratoides* L. = *E. urticaefolium* Reich.; Sneezewort (*Helenium autumnale* L.); Ragwort (*Senecio Jacobaea* L.).

68 - **The "Whorled Milkweed„ (*Asclepias galioides*), a Plant Poisonous to Livestock.** — Marsh, C. D., in *U S. Department of Agriculture, Department Circular* 101, pp. 2, 1 fig. Washington, D. C., May, 1920.

The whorled milkweed grows abundantly in some sections of southwestern Colorado, southern Utah, and the northern counties of Arizona and New Mexico. It is from 1 to 3 feet in height and is not found above an altitude of 7500 feet. It is one of the most poisonous of the plants injuring livestock. As small a quantity as 2 ½ oz of the green plant may kill a sheep, and 2 ½ lb., may kill a 2-year-old steer. Horses are not likely to eat it, but if they do they are as easily poisoned as sheep. Many animals have been killed by eating hay containing the dry plant. No remedy has been found. The plant is exceedingly difficult to eradicate, but, by cutting it down before the seeds are formed, much can be accomplished in pastures and along trails.

69 - **Studies on Dourine** (1). — Formad, R. J. (Pathological Division, Bureau of Animal Industry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. XVIII, No. 3, pp. 145-154. Washington, November, 1, 1919. — II. Sergent, E., Donatien, A. and L'Héritier, A. (Pasteur Institute of Algeria), Des étalons guéris cliniquement de dourine peuvent rester des porteurs sains de germes pathogènes, in the *Bulletin de la Société de Pathologie exotiques*, Vol. XIII, No. 7, pp. 515-518. Paris, July 7, 1920. — III Sergent, E., Donatien A. and L'Héritier, A., Du diagnostic expérimental de la dourine, *Ibid.*, pp. 518-520. — IV. Clerici, A., Malattie infettive dei cavalli, nuovi metodi di cura, in the *Industrie Italiane Illustrate* (I. I. I) Section D. Agricoltura, Alimentazione e Industrie agrarie, No. 10, p. 14. Milan, October, 1920.

I. — The most essential factor in the suppression of dourine is a correct diagnosis. For this reason, the Bureau of Animal Industry of the U. S. Department of Agriculture has devoted much attention these last 5 years, to perfecting the technique of the complement fixation test as applied to this disease.

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(1) See *R.* Jan. 1916, No. 72. (*Ed.*)

In the literature dealing with dourine, the clinical phase (etiology, symptoms, treatment) have received far more attention than the pathological phase, namely, the alterations this disease produces in the tissues of the animal. As little has been done in the United States to determine whether the microscopic changes described by European investigators are identical with those observed in horses in north America that are attacked by dourine, the author has undertaken the study of this question, and has obtained the results given below.

Microscopic examination of the brain reveals no appreciable changes in the nerve cells, supporting tissue, or blood vessels; the existence of lesions cannot be demonstrated, even by aid of the most delicate staining methods, in any part of the cervical, anterior, or dorsal portions of the spinal method. In the posterior dorsal part, the lesions were very slight but gradually increased in severity in the lumbar region becoming very accentuated in the region of the sacrum.

In all the phases of the disease degeneration of the sensory ganglia was present, to an extent that varied from the initial chromatolysis stage, which was scarcely revealed by NISSEL's method, to the advanced degeneration and disintegration present at the plasmolysis stage. The cells of the motor ganglia and those of CLARK's column showed such slight alterations that it was difficult to observe chromatolysis The nerve celles of the spinal ganglia showed different degrees of chromatolysis. The most noticeable changes were those taking place in the sensory nerves of the sacral region where the disintegration of the chromatophyll granules was followed by atrophy and sclerosis, and invariably accompanied by a peripheral displacement of the nuclei This was not observed in the nerve celle of the spinal chord.

The degeneration of the myelin in the medullary fibres was as accentuated as the degeneration of the nerve-cells. The black glomerulae of degenerated myelin stained with osmic acid, according to MARCHI's method, were characteristic of the endoneural and extraneural fibres of the grey matter of the dorsal processes and the roots of the dorsal nerve, as well as of the *funiculus cuneatus* (BURDACH's column) and the *funiculus gracilis* (GOLL's column) in the white matter of the spinal marrow. The changes were confined to the lumbar and sacral regions; the degeneration was still more marked in the sciatic nerve. It may therefore be concluded that the origin of the disturbance is rather peripheral than central.

II. — In 3 stallions that were clinically cured of the disease, perfectly fit for service, and with blood which was no longer infectious, even if several litres were examined, the authors observed the sudden re-appearance of the trypanosomes in the peripheral blood, after 14 months, 2 years, and 3 months, respectively.

A stallion effected by dourine may thus remain a source of infection, even when to all appearance it is perfectly cured. Hence, all stallions that have had dourine should be excluded from the stud, and ought to be killed or castrated, according to their condition.

III. — 1) The pathogenetic agent of dourine (*Trypanosoma equiperdum*) occurs sometimes in such small numbers in the general circulatory system of horses with all the symptoms of a severe attack of the disease, *i. e.*, the typical " plagues ", etc., that the inoculation of animals susceptible to the malady, even if $^{1}/_{50}$ or $^{1}/_{60}$ of the whole total blood-volume of the horse is injected at the same time, has, no effect.

(2) Thus, only positive results of inoculation are of any use in the diagnosis of dourine or in estimating the results of treatment.

IV. — Dourine is one of the most interesting of the infection diseases of the horse to which veterinary science has of recent years been obliged to devote special attention. Though for nearly 80 years it had not been seen in Italy, dourine reappeared in 1919, and owing to the difficulty inexpert veterinaries find in diagnosing the disease, it became very widespread in North and Central Italy and in Sicily When it was first reported from Crema, during the covering season, Prof. STAZZI had discovered 60 cases among the stallions and over 1 000 among the brood-mares. As soon as the epidemic was recognised and rigorous measures adopted for stamping it out, the disease became of much less frequent occurrence, and during the covering season of 1920, at Crema itself, Prof. STAZZI only reported a single case among the stallions and 9 cases among the mares.

Dourine has long been known in Europe, owing to its frequent appearance during the last few centuries in France and the Western States of Germany, where it was introduced by Arab stallions from Africa. The name, it bears was given to it by the Arabs. It has, however, been stated that the disease, which has recently broken out in Italy, is not absolutely identical with the African dourine, but is another form of the malady which is wide-spread in Russia, Hungary, Croatia, East Prussia, Rumania, and Bulgaria. In order to distinguish it from the other type, it can be called the " malignant coition disease " of East and North Europe

This identification rests upon the identity of the pathogenetic agent, on the symptoms, especially upon the course of the malady, and finally upon the epidermiological symptoms, for it has been observed that this time also, as in the case of the outbreak of 1838-1840, the disease entered Italy across the Eastern frontiers The same form has also been predominant since 1886 in North America (United States and Canada).

This malignant coition disease is very contagious, and is transmitted, as its name implies, at the time of service. For this reason, as well as on account of the resemblance of some its symptoms to those of syphilis, it still goes by the name of " horse syphilis ". The pathogenetic agent is *Trypanosoma equiperdum.*

The symptoms of the disease are very variable, and its course often shows great differences from one case to another, although as a rule it is less rapid and fatal than the similar disease which originated in Africa. Thus in outbreaks of the E. European form, the mortality is never so high (80 $^{0}/_{0}$) and much more success has been obtained with prophylactic and systematic treatment than in the case of the African type.

During the course of the disease, 3 phases are generally to be distinguished.

1st *phase*; *initial symptoms.* — These usually take the form of a swelling of th external genitalia, accompanied by ulceration. There are never many ulcers, and often only one. In many cases, these symptoms are not very noticeable, hence the first phases of the disease frequently escape observation.

2nd *phase, or that of the plagues.* — At this stage, the trypanosomes have already penetrated into the blood; if some of them remain in the smalle t vessels in the skin, inflammation sets up and shows itself in the formation of plagues of the most varied form: rings, half-circles, bands, pads. These plagues constitute one of the most typical symptoms of the disease.

3rd *phase or that of nervous troubles.* — These disturbances are caused when the trypanosomes are located in the trunks of the nerves and in special regions of the nervous system. They differ according to whether the nerve alone or the nerve centre is attacked; thus disturbances are observed such as itching, sharp pains in the back legs, as well as malnutrition of the tissues (herpetic eruptions, occurring along the croup or the intercostal spaces); intermittent swelling of the abdomen or flanks; difficulties of movement.

Among the last-mentioned troubles, some are so characteristic as at once to reveal the nature of the malady. Thus, when the nerve trunks which innervate the limb muscles are attacked, the lower segment of the limb tends to fall; hence, the animal, to avoid stumbling at every step; raises this part of the leg much higher than normally, so that it seems to slide first on one leg and then on the other. When, however, the nerve trunk supplying branches to some of the respiratory organs is affected, rapid paralysis of respiration may ensue, and then the animal, after drawing several irregular, rattling breaths, dies almost instantaneously.

As regards treatment, owing to the manner by which contagion is effected, control mesasures are easily applied. Strictly speaking, all that is necessary is the scrupulous observance of the rules of hygiene and of cleanliness already laid down by veterinary science for the purpose of combating the infectious diseases of animals. In other words, no animal whether male or female must be used for reproductive purposes, if it is suffering from this malady. By rigorously carrying out this system, Prof. STAZZI has succeeded in reducing the propagation of the disease to a minimum in the district of Crema, where last year it had already assumed disquieting proportions. French veterinarians accustomed to control dourine which, as has already been said, is more malignant than the coition disease now present in Italy, also employ individual prophylactic measures at the moment of service in districts where the malady has been reported, and rub an antiseptic ointment upon the external genitalia of the brood-mares. This, however, entails some loss of time and considerable expense, and it has been found in Italy that the same end can be attained by simple supervision.

When the disease has already broken out, good results have been obtained in many cases by the use of arsenical compounds, such as atoxyl and salvarsan, which have been employed against several other disease due to trypanosomes. The latter, which is made in Germany can be substituted by an Italian product, jacol, which leaves nothing to be desired, either as a regards its mode of application or its effect.

70 - **Aphthous Fever in Indo-China** (1). — I. SEILLIER, E. A. (Directeur des Etablissements Messrs Lapicque et Cie., Laos), La fièvre aphteuse au Laos, in the *Bulletin Scientifique de l'Institut de Saigon*, Year II, No. 9, pp. 260-262. Saigon, September, 1920. — II. LE LOUET, G. M. (Directeur du Service Vétérinaire, Zootechnique et des Epizooties de Cochinchine), La fièvre aphteuse, considérations techniques. *Ibidem*, pp. 257-160.

I. — At the beginning of March, 1920, aphthous fever appeared in Laos (and in Siam) among the work-oxen. Few of these died, and the disease nearly always attacked over-tried animals, the breeding herds of the peasants remaining almost immune. The buffaloes were the first to contract the fever.

The natives have no empiric remedy for the disease, as it seldom occurs in Laos, its last appearance there dating back to 1899 or 1900. The symptoms were little defined, and many animals recovered without their owners troubling about the matter or separating them at night from the healthy individuals. Naturally, the disease soon spread to the breeding herds, and then the author was able to follow its course fairly accurately. He gives some data as to the course of the disease and advice regarding the treatment of infected animals and the precautions to be taken to prevent the spread of the fever.

II. — On reading the preceding article the author was induced to collect some technical data referring to aphthic fever in general.

This question is of paramount importance to Indo-China, as the disease is now rife in Annam, Cambodia, Cochin-China, Laos, and Siam, and perhaps in other regions that have relations with the Indo-Chinese Peninsula.

According to the author, the spread and virulence of the disease in Indo-China are restrained by the combined action of the light, the solar heat, and the extreme dryness of the air, which is a very strong action in this tropical country and quickly renders innocuous the aphthic virus, as, in spite of its subtlety and easy diffusibility, it is quickly destroyed.

The author mentions useful data regarding the disease, questions of immunisation, relapse, aphthisation, etc.

71 - **Inoculating Cattle against Tuberculosis.** — CALMETTE, A. and GUÉRIN, C., in the *Annales de l'Institut Pasteur*, Vol. XXXIV, No. 9, pp. 553-560 1 fig. Paris, September 1920.

The experiments carried out by the authors from 1912-1915 revealed the following facts:—

(1) By means of successive series of cultures of the bacillus of bovine tuberculosis, a race of non-tuberculigenous bacilli can be obtained

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(1) See *R.* Sept., 1920, No. 882. (*Ed.*)

that are perfectly tolerated by cattle and other animals susceptible to the virus of tuberculosis.

(2) This non-virulent race behaves as a true vaccine, in that, when injected in the right amount into the veins of cattle, it makes these animals immune, not only against experimental test inoculation, but also against infection due to living in close quarters in a contaminated shed.

(3) This immunity, which presumably depends upon the presence of the non-virulent bacilli in the organism, only lasts 18 months after vaccination, but it can be conferred again by annual vaccination, a process which in itself is quite harmless.

72 - **Species of Cattle Piroplasma and Their Carriers.** — BRUMPT, E. (Laboratoire de Parasitologie de la Faculté de Médicine de Paris), in the *Bulletin de la Société de Pathologie exotique,* Vol. XIII, No. 6, pp. 416-460. Paris, June 9, 1920.

The author gives a detailed account of the micro-organisms producing cattle piroplasmosis, namely 7 species of *Piroplasma* and 2 species of *Anaplasma,* and he describes the morphological and biological characters that distinguish them.

The species studied are: —

Piroplasma bovis, transmitted by *Ixodes ricinus* (*Haemaphysalis punctata*), is probably an accidental parasite of this species.

P. argentinum, transmitted by *Margaropus australis. P. bigeminum* transmitted by *M. annulatus* and kindred forms: *M. australis* in Australia, *M. decoloratus* in S. Africa, and *M. calcaratus* in N. Africa; it has also been transmitted experimentally by *Rhipicephalus appendiculatus* and *Haemaphysalis punctata.*

Theileria parva is usually transmitted by *Rhipicephalus appendiculatus* (= *R. nitens*) which changes its host 3 times. *R. evertsi, R. capensis,* and *R. simus* can also transmit this organism. Some writers consider *Hyalomma aegyptium* also as a carrier. In Macedonia, Trans-Caucasia, and Tunisia, *Rhipicephalus bursa* and *R. sanguineus* are also probably carriers of *Theileria parva.*

Theileria mutans is transmitted by *Rhipicephalus simus, R. evertis* and, occasionally, by *R. appendiculatus.* It also be spread by *Hyalomma aegyptium,* while *Rhipicephalus bursa* and *R. sanguineus* are other suspected and probable hosts.

Anaplasma marginale can be transmitted by *Margaropus decoloratus* and by *Rhipicephalus simus. Anaplasma centrale* is transmitted by *Margaropus decoloratus.* The carrier of *Anaplasma argentinum,* which is morphologically identical with *A. marginale,* and is believed to have been introduced into South America by cattle imported from Spain, has not yet been determined, but is probably a species of *Amblyomma.*

It has hitherto not been possible to decide the pathogenic function of *Piroplasma hudsonius bovis* in British Columbia, but it is probably transmitted by *Dermacentor venustus.*

The cattle of Algeria and Tunis are often attacked by different diseases having in common the symptoms of more or less pronounced jaundice, serious anaemia, and often high fever, sometimes of a hemoglobinuric type. These affections are all known by the Arabs under the names of " Soufir ", Bon-Soufir " or " Soufir-ghrabi ", and are called jaundice by the colonists. It is probable that these forms of jaundice are the same as the " gall-sickness " of South Africa. These diseases are some of the most serious hindrances to stock-rearing in North Africa. In Algeria and Tunisia, they are found chiefly on low, damp ground, and seem to occur but rarely on the high plateaux.

According to the author, the name jaundice is given to different diseases, and in particular to:

(1) A form of piroplasmosis due to *Piroplasma bigeminum*, transmitted by *Margaropus calcaratus*.

(2) Affections produced by *Theileria mutans*.

(3) A form of anaplasmosis produced by *Anaplasma marginale*.

(4) A disease of which the etiology is so far unknown, but which goes by the name of bilious hemoglobinuric cattle fever.

73 - **The Origin of Lactose and Lactosuria in Cows** (1). — CAMPUS, A. (College of Veterinary Medicine at Turin), in the *Nuovo Ercolani*, Year XXV, No. 12, pp. 151-157. Turin, June 30, 1920; Nos. 13-14, pp. 161-170 + bibliography of 48 publications. July 15-31, 1920.

After having set forth all the different theories as to the origin of lactose, the author suggests 2 possibilities:— (1) That one molecule of glucose is transformed into galactose, and that by the subsequent union of this with a glucose molecule, lactose is formed; (2) that lactose is the result of the union of two glucose molecules, with the formation of a disaccharide, which is afterwards changed into lactose by means of a stereochemical modification.

Seeing how few experiments have so far been made in this connection, it is impossible to say which hypothesis is correct. It is certain, however, that lactose is derived from the glucose contained in the blood, and that glucose is transformed into lactose in the mammary gland.

Studies of lactosuria in animals are few in number, there being only those of LEBLANC and PORCHER.

In the urine of pregnant domestic animals, the presence of lactose has often been observed some days before delivery. The author has found it 16 days before calving, in the case of one cow, and 14, 9, or only 2 or 3 days before in that of others. Although the elimination of lactose usually continues, it is frequently intermittent. In a well-fed Piedmontese cow, producing 15 litres of milk a day, lactose appeared in the urine on the 16th day previous to calving, disappearing on the 15th, and reappearing on the 10th day, only to disappear once more, and to return 3 days before calving.

As regards the amount of lactose eliminated during the period preceding delivery, this has been found to vary in different animals. According to **Porcher**, it seems that, in some cows, the lactose increases every day, attaining its maximum on the day of calving. Other observers maintain that the amount varies every day and sometimes very considerably.

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(1) See *R.*, Jan., 1919, No. 79. (*Ed*)

The results obtained from the examination of the urine of a Valdostana cow, 7 years old, which in the full lactation period yielded 20 litres of milk a day, are as follows:—

8 days before calving	traces of lactose were	found in 100 cc. of urine
7 » »	» » » 0.830 gm.	» » » » »
6 » »	» » » 0.955 »	» » » » »
5 » »	» » » 0.670 »	» » » » »
4 » »	» » » 0.475 »	» » » » »
3 » »	» » » 0.545 »	» » » » »
2 » »	» » » 0.504 »	» » » » »
1 » »	» » » 0.545 »	» » » » »
the day of calving	» » » 0.950 »	» » » » »

It should be noted that the amont of lactose eliminated every day shows slight oscillations.

During the period subsequent to calving, the lactosuria lasts only a short time. **Leblanc** and **Porcher** found it until the 6th day, and it seems to be connected with the amount of lactose eliminated before calving.

The lactose content of the urine also varies during 24 hours; thus, in the case of the same cow, in the morning, there were 0.445 gm. in 100 cc of urine, whereas in the afternoon, there were only 0.300 gm. These experiments confirm the truth of another statement, namely, that if milking or suckling is suspended, the lactose either reappears, or the amount evacuated the preceding day is increased. This led the author to conclude that the amount of lactose eliminated in the urine is in direct proportion to the quantity of milk yielded by the cow.

As regards any relation between the amount of lactose present in the urine before calving, and the subsequent milk production, as demonstrated by the two following Tables, giving the amount of lactose in 100 cub. m., of urine from two cows of the same breed and yielding respectively 14 and 20 litres of milk a day during the period of the greatest milk production, the author does not consider himself justified in drawing any practical conclusions.

Cow yielding 14 litres of milk.

7th day before calving	0.395 gm.
6th » » »	0.449 »
5th » » »	0.493 »
4th » » »	0.532 »
3rd » » »	0.476 »
2nd » » »	0.545
1st » » »	0.532 »
day of calving	0.740 »

Cow yielding 20 litres of milk.

7th day before calving	0 830
6th ″ ″	0 955
5th	0 670
4th ″ ″	0 [illegible]7
3rd	0 545
2nd	0 504
1st	0 515
day of calving	0 953

74 - **Inoculation with Serum, as a Prophylactic against Swine Fever.** (1) — GARCIA IZCARA, D, (General Inspector of Hygiene and Veterinary Sanitation), in the *Boletin de Agricultura tecnica y económica*. Year XII, No 138, pp 418-420 Madrid, June 30, 1920

Experiments carried out with a view to determining whether inoculation with serum renders animals immune to swine-fever.

An attempt was made to obtain a more active serum by substituting intraperitoneal injection for subcutaneous injection, and by replacing Iberian pigs, which are excessively susceptible, by Celtic swine, which are very resistant to the action of the virus.

First, 69 pigs were injected with 20 cc ; 10 days later, the animals were injected with ¼ cc, of virus, a third similar injection being made after 10 days. Eight days subsequent to this last injection, the 69 pigs were removed to infected places and divided into 5 lots, the first containing 10 animals, the second 20, the third 6, the fourth 8 and the fifth 25 Lots 2, 3 and 5 were inoculated with the serum in July, 1919, when 3 months old, and until they reached the age of one year, showed no abnormal symptoms Lot 4 was inoculated when the animals were 8 months old, and till they attained 17 months, they manifested no sign of disease. All the pigs had received an injection of 20 cc., of serum, 0 25 cc., of virus being injected the first time and another 0.25 cc. the second time.

Sucking-pigs were also inoculated with serum to see how far they could be rendered immune. Experiments were made upon 1309 of these animals divided into 5 lots, containing respectively 100, 200, 207, 213 and 319 head. All were treated with 20 cc. of serum and received 2 injections of virus, the first of 0.25 cc., and the second of 0.5 cc.

At the time of inoculation with serum, Lot 1 was composed of pigs 40 days old. Nine of them (9 %) died as a result of the treatment, whereas the deaths among the 50 control animals were only 30 %. Lots 3, 4 and 5, which were made up of pigs 15 days old, showed no abnormal symptoms after 3 or even 4 months.

In conclusion, inoculation with serum is to be recommended for large animals when the fever has made its appearance, for the immunity gained is passive and of short duration.

Inoculation with the serum is the method of immunisation that has given the best results in the experiments carried out by the Stock-Breeding Association.

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(1) See *R* April 1912, No 675; *R* Oct 1914, No 920; *R* Jan. 1915, No. 67; *R*. Sept., 1915, No 934; *R* Nov. 1915, No 1176; *R* Nov. 1918, No 1037; *R*. June 1919, No. 749 (*Ed*)

75 - Skimmed Milk as a Supplement to Maize in Feeding.— OSBORNE, T B , LAFAYETTE, B , and WAKEMAN A J , in *The Journal of Biological Chemistry*, Vol. XLIV, No. 1, pp. 1-4, Figs 1. Baltimore, M. D , October, 1920.

Good results had previously been obtained with the mixture of maize meal and skimmed milk in the promotion of rapid growth of young animals as well as poultry. The high cost of these food products and the necessity of their use in the most efficient proportions led to the experiments described in this paper:--

I. — Four albino rats were fed on a mixture of 91.5 % yellow maize meal and 8.5 % of " Krystalak " a preparation of dried skimmed milk containing 35 % protein and 2 % fat. The authors support the statement made by the former investigators HART and STEENBOCK, that a highly efficient protein mixture is not obtained until the proportion of liquid milk to maize meal reaches 1:1 ; in this proportion the milk nitrogen constitutes approximately 30 % of the total nitrogen of the ration. According to other information 88 % yellow maize meal supplies enough of the fat soluble vitamine for normal growth and reproduction of albino rats when a salt mixture containing sodium chloride, calcium lactate and ferric citrate is also added, and the maize proteins supplemented with casein. The authors therefore consider their own mixture to be adequate in respect to this food accessory, but it was found that the salts supplied by the milk were not sufficient to supplement adequately the recognised mineral deficiencies in maize, and it was necessary to add a standard salt mixture before normal growth was made (2). Results indicated that the mixture of yellow maize meal, skimmed milk solids and salts may be slightly deficient in fat soluble protein. The deficiency in mineral matter may however be compensated for by the addition of green fodder to the diet or by the addition of about 1 lb., each of calcium carbonate and sodium chloride per 100 lb., of maize meal.

76 - The Mechanical Power Required for Crushing Oil-Cakes as a Factor in their Selection. — RINGELMANN, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 28, pp. 704-707. Paris, October 6, 1920.

In valuing feeding cakes, their food value represented by the protein content, is the chief factor taken into account. As, however, it is most profitable for the agriculturalist to purchase his cakes whole, the cost of crushing must also be considered, and this varies in the ration of 1:5, according to the hardness of the cakes.

The accompanying Table summarises the results of the experiments carried out with a good type of hand cake-crusher, with a single pair of cylinders, 10 kg., of each cake being used,

According to these experiments, the author thinks the following classification may be made:—

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(1) See *R*, June, 1920, No. 616.

(2) See *R*, October, 1919, No 1175. (*Ed*)

Cake	Country of origin	Density	Protein	Mechanical power used in crushing 1 kg. of cake
			Per cent.	Kg.-metres
Local colza	France	1.20	34.68	85.3
Cotton (1st production)	Egypt	1.19	25.00	88.2
Local flax	France	1.23	31.18	91.9
Sesame	?	1.13	41.67	94.2
Red copra	Singapore	0.93	24.50	96.5
Coconut	Ceylon	0.91	20.55	119.2
Decorticated peanut	Bombay	1.28	47.71	138.9
Cotton (2nd production)	Egypt	1.31	25.00	158.2
Niger	Africa	1.27	38.75	344 8
White poppy	Smyrna	1.21	37.75	419.1

Soft cakes: — local colza, Egyptian cotton (1st production), local flax, sesame, red copra, and coconut.

Hard-cakes: — decorticated groundnut and Egyptian cotton (2nd production).

Very hard cakes: — Niger and white poppy.

This classification as regards the cakes tested, may undoubtedly vary according to the oil-factories.

In short, the protein content is not a sufficient guide to the selection of a cake and the cost of crushing it must also be taken into consideration, that is to say, the mechanical energy required by the operation. An idea of this can be obtained in comparative experiments with cakes, if the same machine set to the same rate is used by counting the number of revolutions required to crush a certain weight of cakes, and by examining the volume and weight of the pieces falling through the sieve, for the production of flour or meal must be avoided as far as possible.

77 - **A Biochemical Study of Copra Meal.** — SANTOS Y ALVAREZ, F. O. (Laboratory of Agriculture, University of the Philippines), in *Phillippine Journal of Science*, Vol. XVI, No. 2, pp. 181-189, bibliography of 22 works. Manila, February, 1920.

A sample of coprah meal from Manila was ground fine, and on analysis showed the following composition:

	Per cent
Moisture	11.3
Oil	12.2
Crude protein	20.1
Ash	5.5
Crude fibre	13.2
Carbohydrates	37.0

A comparison of nitrogen distribution in the hot water insoluble portion of copra meal with cottonseed meal showed that the latter was richer per cent: — in amides 15.37; in cystine 5.93; poorer in arginine, lysine and non-amino, and nearly identical as regards humin (—.67 %) and mono-amino (0.86 %).

The alkali-soluble protein is the most abundant in copra meal; 47.55 % is the total protein nitrogen soluble in hot water.

This percentage appears to be somewhat low when compared with that obtained by OSBORNE and CAMPBELL who were able to dissolve a total of 96.6 % of the protein nitrogen found in lupin seeds.

Copra meal forms an excellent supplementary concentrated feed fed with green leaves.

78 - **Use of *Opuntia* spp. as Forage.** — See No. 59 of this *Review*.

79 - **Hybrid between *Equus asinus* and *E. Kiang*.** — POCOCK, R. J., in *The Field*, Vol. CXXXVI, No. 3542, pp. 703. fig. 1. London, Nov. 13, 1920.

The Zoological Society in London possessed a fine stallion wild ass from Somaliland, the only country apparently where the African ass (*Equus asinus*) still survives as a wild animal. This differs from the domesticated type in one or two points of secondary importance, notably in the sharp definition of the leg stripes; the obliteration or evanescence of the shoulder and spinal stripes, and the big patch of dark colour on the base behind the ear.

With a view to improving the strain of domestic asses, a number of foals were bred from a cross between the Somaliland stallion and a Castillian specimen. Amongst the cross breds thus obtained was a fine female which stands about 12 hands, but, except for her large size and almost total suppression of the spinal and shoulder stripes, scarcely differs at all from a well-bred English donkey. Being the progeny of two races, the Somaliland and the Tibetan wild ass or Kiang (*E. Kiang*), she gave birth to a foal of quite a distinct species. In body colour it is reddish brown like the sire but in other respects it favours the dam, showing no trace of the sharply defined white on the throat and legs characteristic of the Kiang, the legs being dark grey with a few indistinct stripes. There is about the same amount of white on the belly as in the dam, and the shoulder and spinal stripes are faint; hoofs narrow, ears long. Hitherto all true hybrid Equidae have proved sterile, but it will be interesting to discover if that rule applies to the hybrid in question.

80 - **Intensive Production of Baby Beef in France.** — LAPLAUD (DECHAMBRE, *reporter*) in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No 33, pp. 795-798, and 802-808. Paris, November 10, 1920.

M. DECHAMBRE laid before the Académie a paper by M. LAPLAUD dealing with the intensive production in France of the so-called " Baby Beef. "

For some time, a movement has been noticeable in the Press in favour of the intense production of baby beef according to the North American method, which would seem to have originated in that country. For over 30 years, France has regularly and systematically raised remarkable baby beef cattle. Since 1882 M. LAPLAUD (père) has been a large producer of these animals.

The Limousin breed has become famous as furnishing baby beef cattle, and the Charolais race is in no way behind M. G. CORMOULS-HOULES, after trying animals of different breeds, such as the Angle, Tarn, Aubrac, Salers, Garonnais, and Gascon breeds chose the Charolais and Limousin breeds, as being distinguished for their early maturity and large net yield of meat.

Yearling Charolais bulls or heifers have been mentioned (which have been fattened the following winter, and sold at high prices in the spring) as weighing on an average from 500 to 600 kg. The district of Nevers sends to Lyons, young pasture-fed bulls, and heifers, of which the smallest and youngest weigh between 500 and 700 kg., when 2 years old. Those that weigh most are despatched to Paris. Young Limousin cattle sold to the butcher and heifers or bulls, 8 to 16 months old, have a gross weight of from 250 to 450 kg.; the bulls are perhaps a little heavier, but the meat of the heifers is the finer. Heifers and oxen of 16 to 24 months and over weigh between 400 and 650 kg.

At Faillades (Tarn), M. G. CORMOULS-HOULES kept every year in his sheds, some 500 Limousin heifers which, when bought at the age of 12 months, weighed on an average 340 kg. He kept them 8 months, and sold them to butchers in Lyon, their average weight then being 560 kg., so that they had gained 915 gr. per day.

M. DECHAMBRE, during his visit to Faillades, estimated as an average of 5180 gm., the daily gain of young heifers weighing on an average 400 kg., and fed the following rations.

Siloed forage	20 to 25 kg.
Bran	1 kg
Cake	1 kg

Comparative feeding experiments were made at Faillades in November, 1895, with 24 Limousin heifers of the average weight of 400 kg. The results are set forth in the following Table.

Feeding experiments with Limousin Heifers.

of lots	Ration consisting of:	Total dry matter in ration	Nutritive ration	Average increase in live-weight per head, per day
		kg.		kg.
Lot 4:4 animals weighing 1 600 kg	22 kg. siloed forage 9 » boiled potatoes 1 » Egyptian cotton cake	10.610	1:6	1.000
Lot 5:4 animals weighing 1 600 kg.	6 kg. siloed forage 6 » dry hay 6 » boiled potatoes 1 » Egyptian cotton cake	10.250	1:5	1.050
Lot 2:4 animals weighing 1 600 kg.	16 kg. siloed forage 16 » boiled potatoes 1 » Egyptian cotton cake	10.300	1:5,6	1.150

M. LAPLAUD (père) has described to the Société d'alimentation rationnelle du bétail, the rations with which he had reared thousands of young stall-fed cattle (dry hay, beets, Jerusalem artichokes, and cotton cake). Barley-meal, rye-flour, maize, groundnut cakes, maize gluten, etc., may also be given. At Dr. de ROTSCHILDS stock-breeding centre at Vaulx-de-Cernay, groundnut cakes and different kinds of meal (barley-meal, bean-meal, etc.) are fed. This system, having long since shown its financial value, has become generalised, and whole arrondissements could be mentioned where only fat cattle are raised for the Lyons, Saint Etienne, and southern markets.

M. LAPLAUD concludes his note by saying that the best French breeds of beef cattle, which furnish very early animals, are the finest in the world, but they do not occupy the place they deserve.

81 - **Feeding Experiment with Yearling Steers. — I. Winter Rations and Their Influence on Pasture Gains. — II. Use of Silage and the Cost of Rations for Wintering.** — SHEETS, E. W. and TUCKWILLER, R. H. (Animal Husbandry Division), in the *United States Department of Agriculture Bulletin* No. 870, pp. 1-20, tables 12, Figs. 8. Washington, D. C., October 20, 1920.

The report of part of a series of experiments that have been in progress since 1914 carried on in co-operation between the Bureau of Animal Industry and the West Virginia Agricultural Experiment Station to study bee-production problems in the Appalachian Mountain region. The steers used in this work were of the grade Shorthorn, Hereford and Aberdeen-Angus breeding, and averaged from 650 to 675 lb., in weight at the beginning of the winter period and were one year old the previous spring. From the analyses it was evident that the feeds used with the exception of cottonseed meal were somewhat below the average in quality.

I — The following Table gives a summary of gains and losses in weight per steer, winter and summer, and the composition and nutritive ratio of the rations fed each year: (See Table page 101).

The conclusions from these results are that: 1) An average daily ration of 19.8 lb., of maize silage + 5 lb., mixed hay + 2.5 lb. wheat straw fed to moderately good steers weighing 663 lb., (Lot 1) for 130 days during the winter should maintain them without loss in weight: — 2) An average daily ration of 23.1 lb., of maize silage + 4.9 lb., of wheat straw, + 1 lb., of cottonseed meal fed to steers weighing 604 lb., (Lot 2) for 130 days during the winter should maintain their weight and allow an average gain of 62 lb., per steer. — 3) An average daily ration of 11.9 lb., of mixed hay + 4.1 lb., of wheat straw fed to steers weighing 665 lb., (Lot 3) for 130 days during winter would not maintain their weight but would result in an average loss of weight of approximately 35, 4 lb. The steers in Lot 2 receiving a protein concentrate in the ration did not lose weight as in Lots 1 and 3. 5) The steers receiving maize silage as part of the ration made greater total gains for the year than those receiving rations of dry roughage alone; the latter which lost weight during the winter, and those fed on a maintenance ration of which maize silage was only a part (Lot 1), made greater gains during the first 2 months on grass than those steers which had made

Lot	Ration	Average quantity per steer daily	Composition: Dry matter	Composition: Protein	Composition: Carbo-hydrates	Composition: Fat	Nutritive ratio	Years	Average gain (+) or loss (—) in weight per steer in winter	Average gain in weight per steer in summer	Average total gain in weight per steer winter and summer
		lb.	lb.	lb.	lb.	lb.			lb.	lb.	lb.
I	Maize silage Mixed hay Wheat straw	20.0 5.0 2.51	5.26 4.39 2.33	0.220 0 200 0.018	3.000 1.985 0.891	0.140 0.055 0 013	1 : 14.5	1914 – 1917	– 1	317	316
		—	11.98	0 438	5.876	0.208	—	—	—	—	—
II	Maize silage Wheat straw Cottonseed meal	23.1 4.9 1.0	6.08 4.49 0.93	0.254 0 034 0.334	3.465 1.720 0.243	0 162 0 025 0.079	1 : 9.7	1914 – 1918	+ 62	262	324
		—	11.50	0.622	5.428	0.266	—	—	—	—	—
III	Mixed hay Wheat straw	11 9 4.07	10.45 3.73	0.476 0 028	4.724 1.429	0.131 0.020	1 : 12.9	1914 – 1918	– 35	309	274
		—	14.18	0 504	6.153	0.151	—	—	—	—	—
IV	Maize silage Soya bean hay	20.0 6 0	5.26 5 48	0.220 0.702	3.000 2.352	0.110 0 072	1 : 6 3	1917 – 1918	+ 27	240	267
		—	10 74	0 922	5.352	0 212	—	—	—	—	—
V	Maize silage Rye hay Cottonseed meal	20.0 6.0 0.5	5.26 5.51 0.46	0 220 0.204 0.167	3.000 2 760 0.122	0 140 0 066 0.039	1 : 10.9	1917 – 1918	+ 11	281	292
		—	11.23	0.591	5 882	0.245	—	—	—	—	—

considerable gain during the winter; 6) there was a very slight tendency for the steers fed on dry roughage alone (Lot 3) to make less gain during the last 2 months of pasture season than those which had received silage in the ration (Lots 1 and 2) during the preceding winter.

II. — A summary of the comparative cost of the different rations. The maize silage, wheat straw and cottonseed meal (fed to Lots 2) was the cheapest ration used and at the same time the best, making the greatest increase (62 lb.) in weight of the steers. The authors estimate that the addition of maize silage to the ration for wintering yearling steers gave them an increased value of from $ 1.19, to $ 5.79 per head, depending upon the ration used. The feeding methods used in wintering yearling steers added from $ 1.40 to $ 2.85 per cent, to the spring value over the preceding autumn, again depending upon the ration used.

82 – **Field-Peas for Fattening Lambs.** — LONSDALE, T. W. (Manager, Moumahaki Experimental Farm) in *The New Zealand Journal of Agriculture*, Vol. XXI, No. 3. pp. 140. Wellington September 20, 1920.

On many old established holdings the raising of a profitable crop of rape has become somewhat precarious and it has been found necessary to substitute other fodder. The author therefore carried out a short preliminary trial of the fattening qualities of peas and rape respectively. Rape was sown on October 15, and on the same day an adjoining plot of equal area was sown with Partridge peas, both plots receiving similar treatment with regard to preparation and manures. On February 2, a line of crossbred lambs by Southdown rams was divided up and after marking and weighing, equal numbers were placed on each plot These lambs had not received any artificial food previously and had been running on fresh pasture.

The following shows the dates of weighing and average live weight per lamb: —

Lot I (rape) Feb. 2, 58.65 lb.; Feb. 15, 65.80 lb.; Feb. 22, 68.60 lb.
Average gain per lamb, 9.41. lb.
Lot 2 (peas); Feb. 2, 56.35 lb.; Feb. 15, 60.40 lb.; Feb. 22, 69.30 lb.
Average gain per lamb 12.68. lb.
Gain in favour of peas, 3.27 lb. per head.

The lambs on rape made most headway during the first two weeks, but the gain in weight of the lambs on peas during the third and final weeks was remarkable.

Preparations are being made to conduct a similar test on more extensive lines during the present season.

83 – **The Goats of the Mediterranean Countries.** — MANETTI C., in *L'Agricoltura coloniale*, Year XIV, No. 9, pp. 367-376, Florence, September 1920.

In the Mediterranean Basin, the following species of goat are still found in a wild state: —

(1) The Bezoar, Pasang, or Grecian Ibex (*Capra aegagrus*). A tall animal, with a robust body, and sharp horns directed forwards, inhabiting the mountains of the Grecian archipelago, Asia Minor, and Persia.

(2) The Alpine Ibex (*Capra ibex*) with large horns characterised by strong tranverse ridges on their anterior surface, living on the peaks of the Alps and Pyrenees.

(3) *C. caucasica* with brown back and white abdomen, and large triangular horns.

Three races of goats live in the Mediterranean countries (European, Asiatic, and African breeds); and there are numerous varieties of each. The Swiss Alpine varieties, which are the best products of European goat-breeding, belong to the European race.

The white Gessenay variety, orginally coming from the Upper Simmenthal, has a white coat (snow-white or cream) and is usually hornless. Its height is 1.20 m , and its average weight 80 kg: these goats yield 4 to 6 litres of milk daily.

In the Viège Valley, and the Haut-Valais, there is another large-horned. Variety characterised by its variegated coat, black from the head to the middle of the back, the rest being white. Its height is from 70 to 80 cm., and its hair is thick and silky.

The chamois-goat of the Alps is very widely distributed; it lives on the Alps of Suth Switzerland, where it is confused with the Val d'Aosta and Piedmontese goats, animals which it greatly resembles. Its hair is long and silky, of a light-brown colour and it has a longitudinal brown stripe running from the sinciput to the root of the tail. The male has an especially fine coat. The most striking characteristics of this species are its great hardiness in cold places with poor pasturage, and the facility with which it adapts itself to all climates and all regions: these goats are, in fact, as suitable for stall-feeding as for living in the open. Their yield of meat and milk is good.

The Lyonnese goats of Mont Dore belong to another Alpine variety; they live in sheds on the farms, and their rich, abundant milk greatly contributes to the flourishing cheese industry of these regions. They are about 60 cm., high. Their frame is well formed, and their coat is dirty grey or yellowish.

The Pyrenean goats should also be mentioned; they are excellent milkers, and are generally kept in the plains of Béarn, the Basses-Pyrénées, Gers, and Dordogne.

Spain possess 3 much prized varieties of goats, those of Murcia, Grenada, and la Manche, respectively The Murcia goat has a short, sorrel-coloured coat, sometimes with patches of white, chestnut, and black. Its average height is 70 cm., and it is delicately and perfectly shaped. It is a good milker, but its milk is chiefly noted for its high fat content. The Murcian goat is a gentle, good mother, and always has from 1 to 2 kids a season. It is also a very unexacting animal.

This breed has been imported with much success into Algeria, where it has been greatly improved, and has doubled its daily milk yield In France, crossing experiments have been made between this Spanish race, and French and Swiss breeds, especially with Gessenay and Nubian goats. Hybrids with fixed characters and known as the Race of Sainte Geneviève have been obtained. These must be regarded as improved Murcians, both on account of the large amount of fat present in their milk and the good flavour of their meat. Castrated he-goats yield, when killed, about 9 kg., net of fat (melted), which can be mixed with natural butter, owing to its excellent organoleptic qualities.

In Dalmatia, Bosnia-Herzegovina, Montenegro, Serbia, Greece, and Albania, the predominant variety of goats is one belonging to the European Sanson breed, which differs distinctly from all other varieties. These goats are of a dolichomorphic type, and vary in height from 67 to 70 cm. Their skull is brachycephalic, the forehead is broad, concave, between the very prominent orbital arches the face is short, and the nostrils are depressed towards their inner surface.

Lively. light-chestnut coloured eye, lyre-shaped horns with transverse ridges which, however, sometimes form a spiral with very wide volutes. Their frame is very strong and shapely. The udders are large, pendent, well formed, and pyriform although the points of attachment are rather large, the teats are regularly arranged, and a little inclined outwards. The hair is very fine and silky. The coat is ashen-grey, but some goats have black, chestnut, very white, and spotted coats This animal is a a good milker and its meat is excellent. The breed is very w ll adapted to rugged, mountain land, its chief quality is extraordinary thriftiness, but in spite of this, it has excellent milk and meat producing qualities.

This variety of goat is found throughout central and south Italy; in the latter part of the country it is mixed with the Maltese breed. All the goats of north Italy belong to Alpine varieties.

In Turkey in Europe, on the West coast of Asia Minor, in Bulgaria, and Rumania, a variety of goats is kept that belongs to the Asiatic SANSON race. They are not tall, dolichocephalous, with rectilineal profile, and elongated elliptical faces Their ears are long and pendent, horns are usually, absent, or replaced by small appendages. The absence of beard under the chin is characteristic in the male. The hair is short, reddish, with patches of black or chestnut and white. This breed is known as the Anatolian.

The Mambrine variety is also excellent and it too belongs to the Asiatic race, which is found in Syria, Persia, Armenia, Palestine, Upper Arabia, and as far as the peninsula of Sinai. There are the two following sub-varieties:—

(*a*) The Meress or Damas goat, with brownish-grey, black, or white coat.

(*b*) The Samar goat, which includes a hornless type known as the "Gara," with black, glossy coat and some reddish patches on the face.

These animals, which are 80 to 90 cm., in height, are characterised by excessively long ears, which sometimes measure as much as 30 cm., in length, although they are scarcely 15 cm., wide. The hair is 25 cm., long and is used locally mixed with sheeps wool for making stuff and carpets. The female is very prolific, bearing kids twice a year, usually, between December and January and between May and June.

The lactaction period is fairly long, even after parturition, and a well-fed goat gives 3 to 4 litres of rich milk daily, which is used for making butter and cream cheese. Aleppo butter is specially prized by the Arabs of Syria. The Mambrine goat is a triple-purpose animal producing hair milk, and meat; the meat has an excellent flavour, and is much liked by the natives. It is a cosmopolitan animal and very well acclimatised to Egypt and Algeria, whither it has been imported, and where it has played a part in improving the native breed.

Amongst the other Asiatic goats living in regions near the Mediterranean, mention may be made of the *Shamy* variety which occurs in Mesopotamia. The *Kurdi* variety is distinguished by its long, narrow ears, which, however, are not so long as those of the Mabrine goat. This goat also lives between the Tigris and the Euphrates, and differs from the former in having shorter ears and thicker coat, of which the hair is however, coarser These two varieties crossed together have produced a hybrid called *Bedui* but of which the characters are not yet throught fixed. Under the name *Merese*, the natives understand the hybrids obtained by crossing Angora goats with different varieties of goats from Syria and Mesopotamia. These hybrids yield a very fine quality of wool known as mohàir.

In Georgia, Daghestan, Persia, Beluchstan, the Isles of the Grecian Archipelago, and even in Crete and Cyprus, the *Bezoar* or Grecian ibex is still found wild, but it is of no value from the stock-breeding point of view. Two domestic species greatly resembling it live in the Caucasus and in Daghestan; they are chiefly valued for their coats.

The Daghestan goat, which is about 60 cm. high, has a grey coat with very long hair (35 cm); the meat and milk are little appreciated on account of their rank odour.

The Caucasian goat has a grey, reddish, or spotted coat, and is easily recognised by its long horn directed upwards for their whole length and curving inwards at the tip in a single whorl. The milk of this goat is richer and more abundant than that of the preceding varieties, and is used for making butter and cheese; its meat is also excellent, but its coat is the most valuable part of the animal, for 2 skins yield nearly 2500 gm., of hair. This goat-hair is used in Anatolia and Armenia in the manufacture of carpets.

Of all the goats of Western Asia, however, the Angora is the most improved variety. This variety is kept in Anatolia, and especially in the Provinces of Brousse, Costamuni, Sivas, Van, and vilayet of Konia. The natives refuse to sell stud animals of this breed to foreigners. The Angora goat is small, scarcely 60 cm. in height. The horns of the male are long with a helicoidal surface, and the ears are long and pendent. The coat is very valuable and consist of tufts of smooth long hair, sometimes crimped or frizzed. The hair is white, long, and silky, and mixed with down; it falls naturally in the spring, but the animal is shorn in April or May and the coarse hairs are removed with the aid of a wooden comb. The hair is used in making fine materials and especially in the manufacture of mohair. Some selected threads were formerly used in making Utrecht. The hair of the male is more abundant but coarser than that of the female; castration improves the quality of the coat. Although the udders of the Angora goat are small, the milk is abundant and very rich in fat; it is used in the manufacture of cheese. The meat is very delicate and much relished in Turkey, where before the war it used to sell at 3 piastres (0.60 fr., at par) per kg., The *Angora* goat is satisfied with poor pastures, where the vegetation consists for the most part of shrubs and steppe plants, and this variety has even become acclimatised to the saline soils of the plateaux of central Anatolia, where no other variety can thrive.

Angora goats are distinguished according to sex and age by the following names:

(1) Oglacks: kids up to 1 year of age.

(2) Tchebichs; kids above 1 year, old, but less than 2.

(3) Erketchs;: adult males reserved for breeding purposes or shearing.

(4) Damisleks; adult females above 3 years of age, and being triple-purpose animals (producing milk, meat and hair). The hair yield of these animals is 375 gm., in the case of the Ogloacks, 500 gm, in that of the case of the Tchebechs, and 1 kg, and 700 gm., respectively in the ease of the Erketschs and Damisleks. The value of the hair naturally varies according to the individual, and as a rule it is the males that take the palm for the beauty and quality of the hair, which should be white, glossy, and flexible to the touch.

The Angora goat is quiet and thrifty, but must be partially fed, especially in winter; for this reason, the shepherds prepare, in addition to the ordinary straw, reserves of siloed forage kept in simple holes dug in the groun dand covered with planks, soil and stones. This silage consists of the common plants of the plateau pastures mixed with vine-leaves, branches, oak twigs and other roughage, which however, the goats eat with avidity.

The Angora goat industry is very remunerative to the natives, seeing the large demands for the products and their high prices as compared to the low cost of production.

For a long time, attempts have been made to acclimatise and breed. Angora goats in Europe, but although stud animals have been imported for the purpose, no important results have been obtained.

On the other hand, these animals have been reared with conspicuous success in Cape Colony and the Transvaal, where there are now over 2 million head, and they tend to increase to such an extent as to threaten to become serious rivals of the Angora goats in Anatolia itself. It is reckoned, that Cape Colony annually exports 11 million Angora goat skins.

These goats have also been successfully reared in the United States, especially in Texas, New Mexico, California, Nevada, Florida, Oregon, and Louisiana, Australia has also begun to breed Angora goats, and has found it very profitable.

The author advises this breed for Libia and especially for Cyrenaica. In the north coast of Africa, the African breed of goat is found; this is composed of several varieties some of which are very important economically, both for their great thriftiness and their resistance to all the changes of climate.

The Egyptian goat is a variety of the African breed. It is not tall (0.60 m.) ; it is dolichocephalic, and has long, broad, pendent ears. The female is nearly always hornless, and the horns of the male are very small. The forehead is concave, the orbital arches are not prominent, the head is light, the thin neck has a depression where it meets the withers; the body is slim, and the legs are slender.

The good qualities of this breed are its gentleness, large milk yield, and extraordinary thriftiness, which enables it to live on land where other animals would starve. The Egyptian goat is not a great wanderer and does very well in the shed. It coat is fawn-coloued with chestnut patches, and its short hair is of no commercial value. The meat, however, is excellent.

The following native varieties of goats are also found in North Africa: Tuoareg; Fouta Djallon, Sokoto Haoussa (Central Africa): Soufo or Touggourt (E. Sahara Constantine); Nubian; Maltese; and also the Libyan, Tunisian, Algerian, and Moroccan varieties.

The Touaregs breed a short haired goat with black, white, yellow, or spotted coat, which is much valued as a milker, and because it is not exacting as regards food.

At Fouta-Djallon (French West Africa) there are goats still smaller than those previously mentioned, and characterised by their wheat coloured coat and a dark chestnut dorsal stripe like that of a mule.

The small goat reared in Haoussa are white, spotted with black; they give very little milk. The goats of the White Nile are black; they still live in the wild state and are of no interest from the point of view of stockbreeding. They have been imported into Europe and America as ornamental animals for parks.

The Nubian goat must be mentioned, especially for its milk yield. It may be regarded as the ancestral stock of all the other varieties of goats bred on the Barbary coast.

It is not tall, the outline of the head is cyrtoid, and the ears are flat wide, long and pendent. Its specific characteristic is accentuated prognathism. The female is hornless and the horns of the male are small. This goat is especially suited to hot, dry climates, and does not thrive on mountains or damp pastures. The female is very prolific, and bears young twice a year, giving birth to 2 or 3 kids at a time. The Nubian goat is an excellent milker; the milk has a high fat content, and is free from the rank smell characteristic of the goat.

The Maltese goat belongs to a variety of the Nubian breed but has become very distinct from it, which shows the influence exerted by environment upon shape. There are in fact, in all the coast regions of Barbary, numerous varieties of the Maltese goat which, in their turn, differ greatly from the original type. The Maltese animal is not tall, its neck is slight and long, body elegant and slender, legs fine and straight, with regular action, The coat is white, or sorrel, or has reddish-white patches. The hair is long, fine and silky; the chin beardless; the horns are small. The Maltese goat can be kept in the stall or in the open. It eats less than the Arab goat, and yet yields more milk; in the height of the lactation period, it gives as much as 3 to 4 litres daily. Its meat is excellent and preferred to that of other goats, owing to its .low price and freedom from rank smell. The Maltese goat is very prolific; it can bear young twice a year, and has 2 or 3 kids each time. It is of a gentle disposition, and easily led; if kept in the stall and well fed, its milk yield is considerably increased. In Libia, the most common varieties of goat are the Nubian crosses between the Nubian and Maltese breeds, commonly known as Arab goats, and the Maltese. The last mentioned varieties are chiefly found near centres of population, while the first-mentioned compose the large, travelling herds of the interior.

The Kabyle goat is met with in Tunisia and Aures, its hair is long and flexible, and its horns well developed. Its milk-yielding capacity is but little developed, and its milk is not very sweet, having a strong unpleasant odour though the fat content is high. There is also a hornless sub-variety of the Nubian, which is known by the name of Arab goat. It stands higher than the preceding animal and gives more milk.

Along the whole coast running from Tripoli to Algiers, by way of Tunis, numbers of goat-breeding centres are to be met with. There, Maltese goats, as well as other breeds and varieties are reared, mostly, however by Europeans, for Arabs rarely keep these animals, having a traditional and natural repugnance to them. At the present time the introduction of Maltese goats into Algeria, Tunisia and Morocco is prohibited under heavy penalties, for it was believed that their milk serves as a means of transmitting *Micrococcus melitensis*, the pathogenetic agent of Maltese or Mediterranean fever. More recent investigations have, however, shown that this disease is now endemic in all the basin of the Mediterranean, and that it is very possible that it is transmitted also by goats of other races.

In Algeria, as has been said, there are also specimens of Angora and Spanish goats. The latter are chiefly bred in the Department of Oran and throughout Morocco; the varieties most frequently found are those of Murcia and la Manche.

84 - **Precautions to be Taken in Natural Incubation.** — RASQUIN, M., in the *Revue avicole*, Year XXX, No. 10, pp. 5-7, Paris, October 1, 1920.

There are many reasons for failure in hatching-out chickens, and therefore it is a most necessary to neglect no precautions.

(1) One of the first of these is the destruction of any vermin infesting the sitting hen, otherwise, she may frequently leave or even desert the nest, and thus prevent the eggs hatching. In order to destroy these pests, a provisional nest lined with hay is made: in this are placed some china, or plaster eggs. The whole body of the fowl is covered with pyrethrum powder by blowing the latter over it with the aid of small bellows.

The fowl is then placed on the prepared nest, and after 24 hours she is removed to put her on the sitting of eggs in the regular nest. The first nest, which contains all the vermin, is burnt.

Afterwards, it is advisable to provide the sitting hen with a dust-bath consisting of fine cinders mixed with flowers of sulphur or a little pyrethrum powder.

Some poultry-breeders, on detecting the presence of vermin, fill an empty egg-shell with a piece of sponge soaked in encalyptus oil and lay it in the nest.

(2) The sitting of eggs, whether sent by rail or otherwise should not be put under the hen as soon as it arrives. On the contrary, the eggs must be left quiet for 24 to 25 hours, in order that the germ may regain its equilibrium and during this time the eggs should be turned at least twice.

Special cardboard-boxes, with partitions, are sold relatively cheaply for setting of eggs, which do much better in these boxes than when wrapped in paper or packed in saw-dust peat, or cereal-chaff for if the journey is of any length, these may impart an odour to the eggs which may have disastrous consequences.

(3) Another matter to which little attention is paid is the cleanliness of the eggs during incubation. Sitting hens that sit too closely often leave droppings on the edge of the nest. In this case, the soiled eggs should be cleaned and washed in tepid water, and then properly dried. Even if one egg should be broken in the process, the rest must be washed all the same. To neglect these precautions is to risk the proper development of the embryo and may entail the loss of the chick.

(4) The sitting hen should be watched during incubation to see if she goes out every day, returns to her nest, etc. Care must be taken to feed her well as for instance with a paste made of wheat, buckwheat, or barley, boiled potatoes mixed with milk, etc From time to time, some earthworms ought to be collected and given to the hen. The hen must always have a supply of food and drinking-water at hand placed in a fixed place, so that the work of supervision may be lightened.

(5) If several hens are sitting in the same place, care must be taken to separate them by proper partitions.

(6) Finally it is advisable not to put more eggs under a hen than she is able to cover; from 12 to 15 is the maximum to be given to an average sized fowl. Otherwise, the other eggs do not receive sufficient warmth, and those in the centre, when the hen pushes them to the outside with her beak, get too cold, which is fatal to good results.

Further, if the hen feels too many eggs beneath her, she distends her wings over much, and in this way the necessary warmth escapes.

85 - **Cost of Feeding Pullets up to the Age of Six months Old.** — BROWN, F. C., in *The New Zealand Journal of Agriculture* Vol. XX, No. 6, pp. 371, Wellington, June 21. 1920.

The trial test was conducted at the Milton Poultry Station at the request of the New Zealand Poultry Association with 29 pullets and 24 cockerels, all white Leghorns. The cockerels were separated from the pullets when they had attained a weight of about 3 ½ lb., and the available marked price was credited to the pullets, and the whole cost of feeding was charged against the latter.

The following are particulers and actual cost of food supplied to the chickens during the 6-months test:

	£	s.	d.	£	s.	d.
Whole wheat, 1008 lb., at 6s. 8*d.* per bushel				5	12	0
Cracked wheat, 187 lb., at 6s. 8*d.* per bushel	1	0	9			
Add cost of cracking	0	1	6			
				1	2	3
Crushed wheat, 112 lb., at 6s. 8*d.* per bushel	0	12	5			
Add cost of crushing	0	0	9			
				0	13	2
Pollard, 769 lb., at £9, 5*s*. per ton				3	11	2
Bran, 254 lb., at £7, 5*s* per ton				0	18	5
Oatmeal, 26 lb., at 6*s*. 9*d* per 25 lb. bag				0	7	0
Hulled oats, 264 lb., at 4*s*. per bushel	1	6	5			
Add cost of hulling	0	6	7			
				1	13	0
Rolled oats, 45 lb., at 35*s*. per 100*lb*				0	15	9
Meat meal, 21½ lb., at 20*s*. per 100*lb*				0	4	4
Total . . .				**14**	**17**	**1**
Deduct price realised for 24 cockerels sold at 4*s* each . .				4	16	0
Net total cost . . .				**10**	**1**	**1**

The average net cost of food for one pullet works out at 6*s*. 11 ¼*d*.

86 - **Control of Foulbrood.** — I. Phillips, E. F. The Control of European Foulbrood in *The United States Department of Agriculture, Farmers Bulletin* 975, pp. 3-16, Washington, D. C., July 1918. — II. Idem. Control of American Foulbrood in *Farmers Bulletin* 1084, pp. 3-15, figs. 5. Washington, D. C., March 1920.

I. — European foulbrood (1) caused by the *Bacillus pluton* varies distinctly from the American disease and it is essential to ascertain which type is actually prevalent before applying treatment. The fact that in many cases both types have been considered manifestations of one disease has led to a spread rather than eradication, owing to lack of proper differentiaton in treatment. The most accurate method of diagnosis is by bacteriological examination, but when this is unavailable, a detailed study of the symptoms is important.

The larva is usually attacked at an early stage of development, while still curled up at the base of the cell. The earliest indications of disease are a slight yellow or gray discoloration, and uneasy movement. The larva

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(1) See *R*, Aug. 1912, No. 1202. (*Ed.*)

becomes slightly translucent and gives a clearly segmented appearance. The position of the larvae is one of the best means of differentation between the two types of disease. In American foulbrood the larvae are almost without exception found on the lower side wall, while in the European type, they may be there or at the base of the cell, or on any of the side walls even the upper one. As decay proceeds with the latter, the colour changes to yellow or gray, and the translucency is lost. This may be taken as the chief characteristic of the disease. Finally, all that is left of the larva is a yellow or grayish brown scale against the base of the cell or a shapeless mass on one of the side walls. The decaying mass behaves like a rubber band which has lost elasticity and breaks when streched and is entirely dissimilar to the fine ropelike condition observed in dead larvae of the American foulbrood.

The disease attacks drone and queen larvae nearly as quickly as those of the workers.

Colour is the most constant symptom, but otherwise there is distinct variability.

Preventive measures. — It is far more important to prevent the disease than to eradicate afterwards. The use of resistant stock is therefore urgent. The use of strong rigorous, three banded Italian stock has been found the best, but a careful selection of the breeding queen has to be made.

Strength of colony is equally important, as this is a disease of weak colonies, and also care should be taken in the proper wintering of the bees. If remedial measures are found necessary, it should be noted that control methods used are exactly the same as those used for swarm control. Either the queen or the brood is removed or they are separated within the hive.

II. — American foulbrood caused by the *Bacillus larvae* attacks colonies of all strengths and at any season of the year when the bees are active. Once in the hive it will remain until the colony is destroyed or the disease effectively treated.

The first indication is the slight brownish discoloration and the loss of the well rounded appearance of the normal larva. The chief symptoms are in the outward manifestation being simply the appearance of the larvae or pupae after death. The comparison with the effects of European foulbrood have already been noted. Usually the disease attacks only the worker brood, and only in rare cases the queen and drone brood. The disease appears to spread more rapidly during a honey flow; all races and strains are attacked. Bacteriological observation has proved that the *B. larvae* is a specific spore-bearing organism which causes this disease to be entirely distinct from all other diseases of bees.

Preventive measures. — No system of management of the apiary has yet been found which will prevent the entrance of American foulbrood. In this respect the disease differs greatly from the first mentioned type. At present, the only advisable proceedings known lie in the observation of precautions which can prevent the bees from getting the honey from diseased colonies.

The actual remedial treatment should be confined to the stoppage of further devastation by removing all material capable of transmitting the cause of the trouble, and not to save the larvae already dead or dying Details are given as to the " shaking " treatment and other treatments at present employed. Box-hives are not advised on any account. The author states also that drugs hitherto recommended are not of the slightest value.

87 - **Pisciculture in Switzerland in 1919.** — *Bulletin suisse de pêche et pisciculture*, Year XI, No. 5, pp. 58-61. Neuchâtel, May 1920.

The following information is astracted from a Report issued by the Swiss Département fédéral de l'Interieur (1).

In 1917-1918 and in 1918-1919 respectively, 203 and 216 breeding stations were working during the incubation period, and 163 768 000 incubated eggs produced 127 785 000 fry. During 1917-1918 and 1918-19, respectively 133 300 095 and 126 863 037 fry were placed in public waters, inclusive of 142 037 fishes of 1 summer or 1 year.

The fry produced by incubation were as follows: —

(a) *Native species* :—	
Salmon	961 000
Salmon-Trout	175 000
Lake Trout	3 850 000
River and Brook Trout	9 415 000
Salmo alpinus	3 907 000
River Charr	1 717 000
Coregones	91 650 000
Pike	15 506 000
(b) *Foreign Species*: —	
Fountain Salmon	591 000
Rainbow Trout	13 000
Total . . .	127 785 000

The Confederation granted 34 700 fr. in 1918 and 39 700 fr. in 1919 to the Cantons for pisciculture, chiefly for raising the fry and stocking the waters.

As the Canton of Valais did not ask for a grant in 1919, no information is at hand concerning their activities. · See table, p. 113.

88 - **Toxic Action of Ingested Linseed Meal on Trout.** — ALMY, L. H., and ROBINSON, R. K., (Bureau of Fisheries United States Department of Commerce, Washington) in *Journal of Biological Chemistry*, Vol. XLIII, No. 1, pp. 97-111, bibliography of 8 works. Baltimore, M. D., August, 1920.

Recently at a commercial hatchery in Rhode Island, a disease broken out among brook trout of 1 and 2 years. The fish turned black, moved convulsively, many of them became blind and large numbers died. It was

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(1) See *R.*, Aug., 1917, No. 752. (*Ed*)

The work of Swiss fish-breeding stations during the incubation period 1918-19.

Cantones	Number of Stations	Fry obtained (in thousands)											Number of fish put into public waters under official control	
		Salmon (*Salmo Salar*)	Salmon-Trout	Lake trout (*Trutta lacustris*)	River and brook Trout (*Trutta fario*)	Rainbow Trout (*Salmo irideus*)	American river charr (*Salmo fontinalis*)	Omble chevalier (*Salmo salvelinus*)	River charr (*Thymallus vulgaris*)	Coregones (*Coregoni*)	Pike (*Esox lucius*)	Total	Fry (In thousands)	Number of fish of a summer and a year
Zurich	12	—	—	49	889	174	13	100	368	8 406	2 992	12 991	11 089	19 400
Berne	47	—	—	65	2 756	35	—	25	969	15 675	—	19 725	14 370	6 840
Lucern	19	—	—	237	504	—	—	69	—	23 068	2 694	26 572	20 419	—
Uri	1	—	—	218	—	—	—	—	—	1 000	720	1 938	1 526	100
Schwyz	4	—	—	17	—	—	—	460	—	1 885	960	3 322	2 936	—
Unterwald-le-Haut	1	—	—	119	—	—	—	—	—	1 050	320	2 069	1 577	1 352
Unterwald-le-Bas	1	—	—	270	—	—	—	—	—	—	—	270	267	—
Glaris	1	—	—	80	130	—	—	—	—	—	—	210	160	—
Zoug	4	—	—	23	2	—	—	1 968	—	5 630	6 523	14 146	12 182	—
Fribourg	6	—	—	—	843	—	—	—	—	5 240	300	6 383	4599	39 289
Soleure	9	—	—	—	315	—	—	—	15	—	—	330	279	—
Bâle-Ville	3	492	186	—	127	—	—	—	—	—	—	805	712	—
Bâle-Campagne	6	270	—	—	800	—	—	—	—	—	—	1 070	713	—
Schaffhouse	1	—	—	—	192	—	—	—	448	—	—	640	554	—
Appenzell Rh.-Ext.	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Appenzell Rh.-Int.	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Saint-Gall	21	—	—	131	1 277	282	6	107	—	16 001	3 110	22 914	15 311	15 130
Grisones	3	—	—	—	230	—	—	—	81	—	—	230	221	2 319
Argovie	34	350	—	—	1 349	—	—	—	—	7 065	100	9 845	8 997	3 770
Thurgovie	8	—	—	—	186	—	—	—	231	20 617	3 822	24 856	17 917	—
Tesino	18	—	—	524	566	205	—	1 424	—	2 150	230	5 099	4 753	—
Vaud	12	—	—	1 982	93	—	—	—	20	4 567	—	6 662	4 936	7 080
Valais	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Neuchâtel	4	—	—	347	211	—	—	—	230	2 800	—	3 588	3 063	28 742
Géneva	1	—	—	—	100	—	—	—	—	—	—	100	95	15 415
Totals	**216**	**1 112**	**186**	**4 062**	**10 570**	**696**	**19**	**4 153**	**2 362**	**118 854**	**21 771**	**163 785**	**126 715**	**142 037**

believed that the disease was connected in some way with the replacement. of a mixture containing cottonseed meal which had formed part of their food, by linseed meal.

The observations and experiments here recorded were made at the commercial hatchery in Rhode Island and at the United States Government hatchery in White Sulphur Springs, West Virginia.

The following points were made clear: 1) That of the two vegetable meal linseed and cotton seed, the linseed meal alone was responsible for causing the change in pigment, blindness, and death; 2) that the causative agent is contained in the non-oil constitutents of the linseed meat; 3) that linseed oil in the food of trout has a slightly intoxicating effect upon the fish; 4) that fish thus affected can be brought back to a heathy condition, except as regards pigmentation and blindness, by a diet of some fresh meat product; 5) that yearling trout fed for 3 months on a diet of hog lungs gained in weight three times as quickly as those receiving the cereal meal mixtures; however, a 3 times greater gross weight of food was consumed in the former case than in the latter. Consequently, a mixture of red dogflour and meat meal is not an adequate substitute for the fresh, packing house products ordinarily used as food for trout.

The injurious effect of ingested linseed meal upon brook trout is due in a large measure to hydrocyanic acid which is present in most linseed meals as the result of the hydrolysis of a cyanogenetic glucoside. The nervousness, pigment change, and blindness are all believed to be attributable to the action of the hydrocyanic acid on the nervous system of the trout. The observations here reported indicate that this action results in an impaired vision, and a consequent interference with the control of the movement of the pigment granules in the chromatophores of the skin, this control normally being obtained by means of stimuli received through the eyes by way of the central and sympathetic nervous systems.

FARM ENGINEERING.

89 - **New Agricultural Implements.** — LARUE, P., in *La vie agricole et rurale*, Year 9, Vol. XVII, No. 45, pp. 278-279, figs. 3 Paris, Nov. 6, 1920.

COMBINED SEEDER AND FERTILISER DISTRIBUTOR. — Economy of fertiliser and more early growth are obtained when the fertiliser is spread in a line in the furrow. For this purpose, a wheel-barrow seeder and fertiliser-distributor has been evolved for market gardening.

A sprocket on the axle drives the fertiliser distributor and the seeder by a bicycle chain. The roller is double and so formed as to leave a raised line of open soil in which the germinating seed can grow freely. The fertiliser distributor is set to use about 11 lb., of fertiliser per acre, the lines being about 1 foot apart.

For seeding, half-a-dozen interchangeable grooves or perforators are provided for different sizes of seed. A tracer guide enables the correct distance to be kept between the lines; it is fitted at the rear, the horizontal bar resting on the vertical supports of the handles.

A HARROW SEAT. — This seat is not a permanent fixture to the harrow, but is a separate attachment mounted on two wheels, drawn by two shafts that pass over the harrow and whose ends are fixed to the wide swingletree that joins the front portions of the harrow.

NEW HARROW TINES FOR MEADOWS. — These tines, invented by WILDER, are designed to avoid the usual fault of easy clogging, and are freer than usual whilst preserving the suppleness of the tines as a whole. They are made in groups of three joined by curved members, as is shown in the accompanying figure. The outer members are joined by chains.

Too little harrowing has been done in meadows, although the operation is said to double the crop.

The harrow can be reversed to increase the life and it can be used to cover light seeds by unhooking.

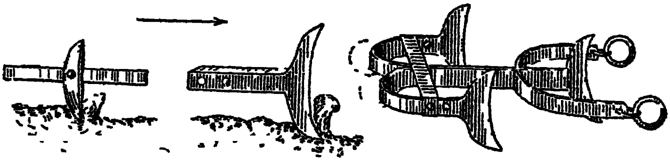


Fig. 1. — New harrow tines

DRAWBAR PULL ON HARROWS. — The agricultural Station of Iowa has recently conducted dynamometer experiments on the breaking-up of oats and maize in sandy soil. Disc harrows (weighing from 5 cwt., to 6 cwt.,), with complete discs required a smaller tractive effort than those with hollow discs, although these were lighter There was little difference when the axis of the discs was perpendicular to the pull. The width worked by the harrow was 9 ft. 9 in., and the depth from 2 to 4 in., and a speed was maintained of 2 ½ 3 m. p. h. usuing from 3 to 5 H. P.

An ordinary square toothed harrow going over lightly after ploughing and with 2 sections 1.5 metres wide, 2-4 h. p. is required to work at a speed of 2 ½ m. p. h. In the second case, two sections were placed in tandem behind the first two, thus giving a double harrowing.

MACHINE FOR SPREADING LIQUID MANURE IN FURROWS — The inventor of this machine, PLATH, has overcome the difficulty of speading liquid manure evenly, another difficulty being that it may evaporate both in the liquid above and on the soil. The idea consists of three hollow tines which are connected to the tank by flexible tubing, the feed being by gravity. A strainer must always be used when fiilling the tank. In this way the liquid manure can be spread in the furrow, so that watering, manuring and tillage are carried on simultaneously. To ensure even distribution, the hermetically closed tank always works at a constant height of liquid. A small liquid manure distributor with two small tines is also made. The liquid manure should be diluted to decrease its alkalinity, with the help of a hygrometer which indicates the approximate content of nitrogen, the content of potash being assumed to be in proportion.

Automatic uncoupling device for tractor ploughs. — A Wisconsin engineer has patented a design of coupling for mechanical-traction ploughs, by which, when the plough strikes a boulder or other obstacle the engine is automatically stopped, the supply being cut off.

Fertiliser distributor. — The fertiliser distributor has followed too closely on the lines of the seeder, and attention is now being paid to spreading by means of centrifugal force. In America, machines are now made to fix behind a cart containing the fertiliser in a loose state. A horizontal revolving endless screw crushes the fertiliser and throws it out over a width about 3 feet. The Duplex model of this machine weighs about 1 ½ cwt.

A new tillage machine. — This machine has been designed by the Société d'etudes pour la construction de machines agricoles to decrease the strain which is put on the wrists and arms when using the ordinary hand type, by using the shoulders instead. The small working members are mounted on a beam suspended from a wheeled pole that ends at shoulder height. The two hands are placed on a guide by which steering is effected.

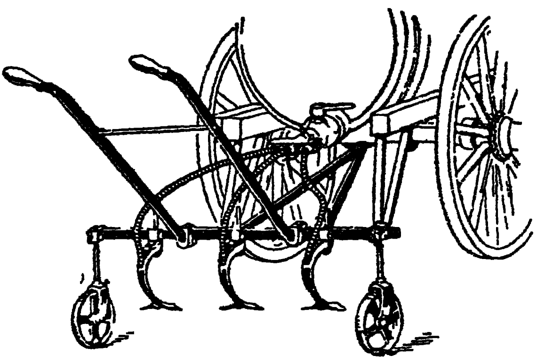


Fig 2 — Liquid manure distributor for furrows

A Pivoted Auxiliary Plough Beam. — The English " Pidsea " plough is designed to overcome the difficulty which occurs in gang ploughs, where the plough bodies are parallel to the beam but not always to the soil, and where the shares may do little work owing to undulations of the ground.

Each plough body has an auxiliary beam articulated vertically with the main beam by 2 connecting rods, the whole forming a sort of parallelogram. A roller fixed under each auxiliary beam and bearing on top of the blade, prevents any tendency to rise and makes the ploughs follow the rise and fall of the ground, but always at a constant depth. It remains to be seen whether the machine is as rigid as the old type, especially when turning.

Supplementary hay carrier. — This supplementary carrier, called the Roberts, and made in England consists of three rows of steel uprights, joined by rope and mounted on a frame which may be put on top of farm carts or lorries. It is very light and strong and greatly increases the carrying capacity of the vehicle.

A HORN SPLINT. — Malformation of the horns of draught cattle is an impediment to driving. In the Garonne valley, where the horns of the Garonne cattle turn down, these horns are sawn off. To avoid this, J. BORGY, a Swiss gentleman, has invented a splint or tube which forces the horn to grow in the right direction.

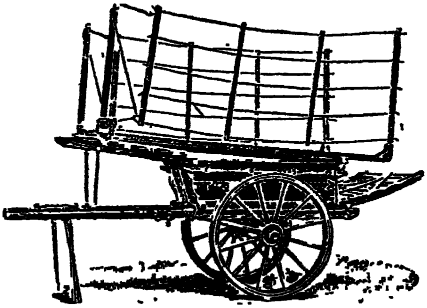


Fig. 3. — ROBERTS hay carrier

90 - **A New Hay-Loader.** — MANRIN, G., in the *Journal d'Agriculture pratique*, Year 84, No. 42, pp 316-317, figs. 2 Paris, Oct., 14, 1920.

This new hay-loader does away with the swaying of the two-wheeled type of machine. This four-wheeled machine, called the " International" is marketed by LA COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES, 155, avenue du Général Michel-Bizot, Paris, 12^o.

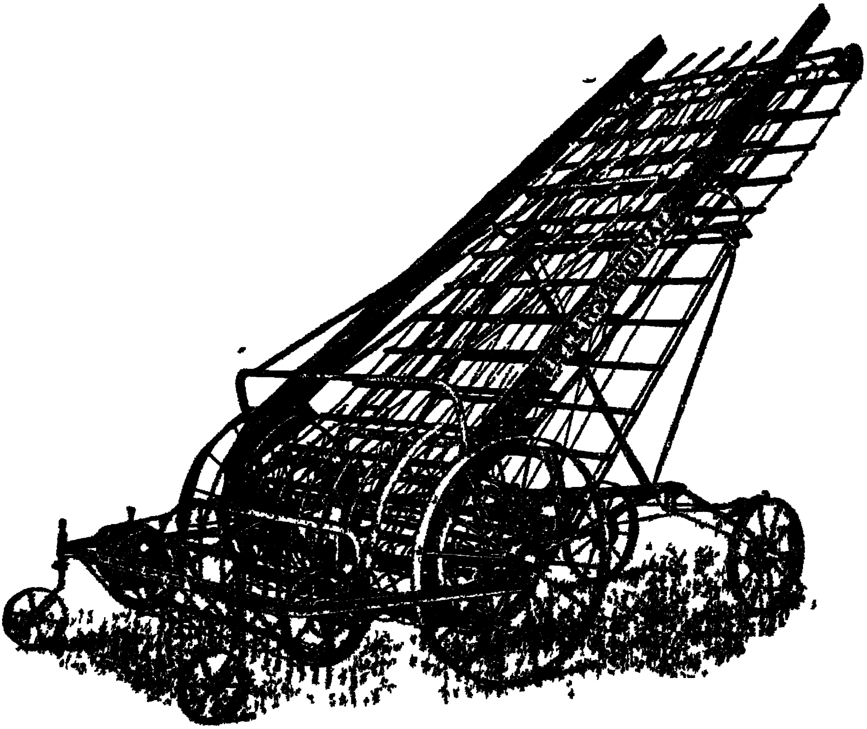
The illustration shows the general design of this model. It is steel built throughout, and is mounted on four wheels, the front ones being pivoted, so that the machine can be hauled either behind a cart or waggon.

The main hay guides are somewhat narrower at the top, so as, to load the hay on the centre of the vehicle, making it easier for the man to spread. A compressor consisting of long springs, holds the hay on to the ledges and chains of the elevator, the tension being easily regulated.

Behind the elevator is the " floating " or " detachable " cylinder, consisting of a metal frame carried by two wheels that can turn horizontally. The frame supports a lattice collecting drum whose radii are furnished with flexible teeth, set at about 3 in., apart. The cylinder, 7 ft. long, is driven by a chain which is kept well away from the hay. About 6 ft 6 in., is covered by the machine, and with 2 or 3 men on the cart a ton of hay can be loaded in about 5 minutes.

91 - **An Automatic Indicator of the Humidity of Cereals.** — CHOPIN, M., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 18, pp. 860-862, figs 1. Paris, Nov. 2, 1920.

The practice of cleaning wheat by damping followed by rapid drying as well as the influence of the moisture content on the results of melting make it useful to know the content. The author of this article has per-

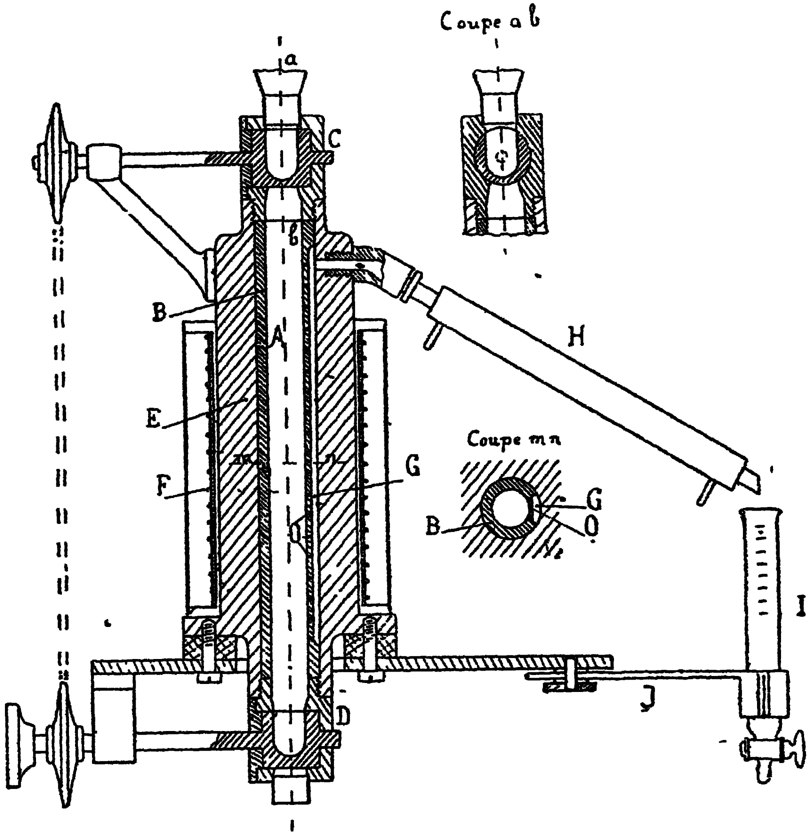


International hay loader

fected an instrument which automatically analyses the humidity of cereals as well as of substances in a powdered or granulated state, samples being taken continuously

The drawing here given shows the essential parts of this apparatus *A* is a cylindrical heating chamber that fits into the socket *B* The top valve *C* acts as the inlet of the grain, etc., and the bottom one *D* as the outer both valves measuring the volume, and slowly rotating so that the holes allow a free passage at regular intervals. As the inlet valve *C* is of slightly larger capacity than the outlet *D*, the cylinder is always kept full; the outward delivery is controlled by *D*.

The cast-iron outer jacket *E* is wound with an electric resistance *F* for heating, which is regulated by a temperature regulator A longitudinal groove *G* connected to the cylinder *A* by small holes *O* conducts the vapour to the condenser *H*; the condensed water can be collected alternatively in two test-tubes such as *I* gratuated in % of moisture, and carried by brackets *J*. The collecting tubes are rapidly substituted one for another under the condenser opening by an electro-mechanical device (not shown in the figure) controlled by the movement of the valve. The result is that the indications given by the machine are, within practical limits, not dependent on the speed of rotation, as the water collects in the tube not in a constant time, but during a determined number of rotations of the emptying valve. Thus, in the machine, a current of wheat flows at a constant rate through a chamber whose walls are kept at a temperature sufficient to dry the wheat almost completely, but not such as to cause a loss of volatile matter.



Automatic indicator of moisture content.

Under these conditions the quantity of steam given off in a given time by the wheat evidently represents its moisture content. The only source of error lies in the substitution of weighing by volumetric estimation, whereby the apparent specific gravity of the torrefied wheat becomes of importance.

Natural wheats were found by the author to have sp. gr between 0.70 and 0.80 so that the sp. gr. of dried wheat lies between 0.63 and 0 67. The resulting average error is therefore acceptable.

This apparatus, installed at the Grand Moulins de Nancy, has been working continuously since August 1919. During that period, the constant of the machine remained invariable, in spite of having been cleaned internally every month. Preliminary tests of 18 varieties of natural wheats or wheats that had received different treatments showed that there was a very satisfactory correlation, between the moisture content and the weight of water collected.

The average error calculated as a percentage of the weight of water condensed was 2 % and the maximum deviation observed was 4.4 %.

This apparatus can be used for other substances and mixtures and for the continuous estimation of constituents other then water

.RURAL ECONOMICS

92 - **The 1921 Wheat Crop in Great Britain.** — MIDDLETON, Sir T., in *The Journal of the Ministry of Agriculture*, Vol XXVII, No 5 pp 421-427 London, Aug, 1920

There is a widespread impression not only that the British wheat grower contributes a trifling amount to the total food supply, but that any effort made to increase the wheat crop would have negligible results. The author however disagrees and lays stress on the importance of home grown wheat and the fact that this contributes more to the food supply of the United Kingdom than any other farm product, with the exception of milk and potatoes.

Estimations as to the nation's resources were made during the war, and it was then discovered that about 42 % of the food was home produced, the chief items in this percentage being: dairy produce 8.3; potatoes 7.4, wheaten bread 6; beef 4, and meat of all kinds 10.5 About 5 million tons of imported feeding stuffs were used in stock feeding, and if the amount of meat and milk made from these is subtracted the total percentage derived through meat and milk from native soil would be reduced to 16.

If 78 % of the cultivated land is required for the production of meat and milk which between them provide about 42 % total food stock from soil, it should also be noted that wheat occupies 4 % only of the cultivated land, and wheaten bread accounts for 16 % of the stock of food grown on the soils. Wheat offals and straw also contribute to the meat and milk supply; before the war less than 70 % of the grain was made into bread. Hence the importance of growing more wheat. The land even now devoted to this purpose produces seven times as much food per acre to that employed in stock farming

The change in the relationship between producers and consumers is very marked since the war, and an increase in home supplies is obviously essential. The rise in the cost of American wheat which has taken place during the last few months is due to a cause which has a peculiar significance for the British farmer. The total wheat crop of Canada, the

United States and Argentina 1909-13, averaged 28 200 000 tons; in 1915, 44 100 000 tons, and an average production 1915-19 of 33 520 000 tons, and last season's harvest, 36 700 000 tons. The American effort made up for the loss of the Russian crop. It should however be noted that in 1920 the United States practically returned to its pre-war acreage and the total yield expected is 22 000 000 tons as against 25 600 000 last year and 18 700 000, 1909-13.

But the United Kingdom is the greatest purchaser of wheat and the United States grows all the wheat she needs and a little more. There is therefore evident necessity in developing the supplies in the former country, now freed from war conditions and limitations. Extensive autumn sowing has therefore been urged.

93 - **Cost of Artichoke Cultivation in the Roman Maremma in Italy.** — See No. 60 of this *Review*.

94 - **Economic Situation of Peach Cultivation in the Department of Casoria (Naples)** (1). — LANDI, R. (R Scuola superiore di Agricoltura, Portici), in *L'Italia Agricola*, Year LVII, No. 8, pp. 233-242. Piacenza, Aug 15, 1920.

For some years now, peach growing has been gradually replacing the cultivation of herbaceous plants except flax in the arrondissement of Casoria.

The author describes the poor methods used in the region, the result being such a degeneration that the life of the peach trees is now only 8 to 10 years whereas formerly it was from 15 to 18 years.

The cultural accounts of a plantation of peach and walnut trees show that in 1919 the costs per hectare were, for the peach trees 1998.55 *lire* plus sinking fund, at 6 %, for 15 years, 194.12 *lire*; and for the walnut-trees, 39 in number, 510 lire plus sinking-fund at 6 %, for 100 years, 27.95 lire.

In reckoning the average expenses of the peach tree the life of the tree is divided into 3 periods: — (*a*) Unproductive (1st-3rd year); (*b*) maximum productivity (4th-9th year); (*c*) period of decline (10th-15th year).; For the walnut there are 2 periods: — (*a*) Unproductive (1st-8th year); *b*) minimum productivity (9th-16th year).

During the first period of the peach, the average is cost 1350.92 lire per annum plus amortisation at 6 % for 12 years (life of peach tree). 151.30 *lire*. During the second period the cost is 3958.12 *lire* and during the third 3067.17 *lire* per annum.

The yield from the peach during its period of maximum productivity averages 200 quintals of peaches a year, which at 50 lire per quintal gives a gross return of 10 000 *lire* and therefore a net profit of 10 000 - 3958.12, or 6041.88 *lire* per annum.

During the period of decline the average crop is 130 quintals giving a gross return of 6500 *lire* and a net profit of 3432.83 *lire* per annum.

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(1) See *R*, May, 1912, No. 804; *R*, Aug., 1912, No. 1183. (*Ed*)

The total gross profit per year for the 12 years is 4732.85 *lire* which, divided amongst the different factors of production gives: — Labour 26.73 %, accidents and supervision 20.90 %, owners profit 25.80 % and the rest in fertilisers, fungicides, insectides, land rent, extras and guarding, interest on farming capital, amortisation.

The cost of the walnut tree during the first period is 470.85 *lire* plus an amortisation of 72.51 *lire* per annum. During the second period the cost is 744.36 lire.

The output is 2 quintals of nuts worth 400 lire per quintal and the net receipts total 55.64 *lire*. The gross revenue is distributed as follows per annum: 40 % for labour; 12.65 % for amortisation; 12.40 % for fertilisers; 12 % for accidents and supervision, the remainder is absorbed by extras and guarding land, rent, interest on farming capital, and the residue 6.95 % is net profit for the owner.

Both in peach and walnut growing the highest percentages are for labour, accidents supervision and amortisation. The high percentage due to labour indicates that peach cultivation is carried out intensively with a high yield, as is shown by the percentages for accidents and supervision.

The total yearly cost of the three associated herbaceous crops is 2 861.85 *lire* per annum during the life of the peach. All the crops together give a gross return of 8 394.70 *lire* per annum which is distributed as follows: —

	Average yearly expenses	Percentage of the basic elements in relation to gross yield	Proportion of distribution gross yearly receipts divided amongst the various items
	lire		*lire*
Fertilisers	413 33	4.50	525.15
Manual labour	2870.00	34.24	3723.52
Fungicides and insecticides	120.00	1.46	161.70
Contingencies and superintendence	342 60	4.13	444.48
Rent	720.00	8.67	939.82
Interest on capital	127.45	1.52	160.56
Accidents and administration	1407.66	16.88	1857.57
Amortisation	445.58	5.33	572.90
Net profit	1948.08	23.27	
Total	**8394.08**	**100.00**	**8394.70**

This table shows the large reciepts obtained from peach cultivation 1948.08 *lire* per annum of which 1220.35 *lire* is due to the peach. This easily accounts for the extension of peach growing. It is interesting to note that the walnut gives a good yield for a number of years and grows well amongst the most productive herbaceous crops.

95 - **The Cost of Vine and Grapes to the Growers of Asti (Piedmont, Italy)** (1).— DALMASSO, G., in *L'Italia agricola*, Year LVII, No. 9, pp. 267-271. Piacenza, Sept. 15, 1920.

In the following tables the author shows :— (1) The present cost of reconstituting a vineyard attacked with phylloxera, i. e., a specialised crop with American vines ; (2) the cost to the producer per quintal of grapes from this vineyard. The distance between the lines is 1.75 metres, between the vines 1 metre, and there are 5700 vines per hectare.

Cost of making 1 hectare of vineyard.

First Year

	Lire
Digging (0 85 0.70 5 700 m. at 2.25 *lire* per metre)	12 825.00
5 700 grafted rooted plants at 1.20 *lire* each	6 840.00
Planting, 1 man for 15 days at 6 *lire* per day	90.00
5 700 canes for first year at 5 *lire* per 100	285.00
Osiers for binding 40 kg. a 0.40 *lire* per kg.	16.00
Planting canes and tying up 10 days at 6 *lire* per day	60 00
Manure at bottom, 15 kg. per plant = 850 quintals at 6 *lire* per cwt.	5 130.00
Superphosphate: 6 quintals at 26 *lire* per cwt	156.00
Manure spreading: 15 days at 6 *lire* per day	90.00
Copper sulphate: 50 kg., (6 treatments) at 250 *lire* per quintal	125.00
Lime, 50 kg. at 15 *lire* per 100 kg.	7.50
Sulphur, 30 kg , at 110 *lire* per 100 kg.	33.00
Labour, 6 sprayings: + 3 sulphurwashes, 8 days, at 15 *lire* per day	120.00
3 weedings 15 days a 7 *lire* (female labour)	105.00
Pinching: 4 days at 7 *lire* (female labour)	28.00
Wine given to labourers: 2 litres per day per 1300 days at 100 *lire* per hl	2 600.00
Upkeep of buildings and roads	30.00
Upkeep and amortisation of machines and tools	30.00
Taxes, general expenses	60.00
Administration and supervision	60.00
Interest on expenditure, 28 690 *lire* at 6 %	721.50
Total . . .	**30 412.00**

Second Year.

	Lire
Replacement of 5 % of plants (i. e., 285)	342.00
Planting: 1 day at 6 *lire* per day.	6.00
Pruning: 5 days at 6 *lire* per day.	30.00
Osiers: 60 kg. at 0.40 *lire* per kg.	24.00
Tying up, 7 days, female labour, at 4 *lire* per day.	28.00
Re-staking, 4 days at 6 *lire* per day	24.00
3 light harrowings, 45 days at 10 *lire* per day.	450 00
Copper sulphate, lime, sulphur, as in 1st. year	165.00
Labour for treatments, as in 1st year	120.00
Pinching, 6 days (female labour) at 7 *lire*	42.00
Piquette for the labourers: 2 litres per 63 days = 126 litres a 100 lire per hl	126.00
General costs: as in 1st. year	180.00
Interest on estimated expenditure 1537.50 *lire* at 6 %	92.25
Total . . .	**1 629.15**

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(1) See *R.*, Oct., 1912, No. 1432 ; and *R* , Oct. 1920, No. 1023. (*Ed.*)

Third Year.

	Lire
Replacement of 2 $^{0}_{0}$ of plants at 1.20 *lire* per 100	120.00
Iron headed stakes 114 at 3 *lire* each	342.00
No. 14 guage iron wire: 11 100 m. (35 m. per kg.) at 3.30 *lire* per quintal	1 072.50
Props, 800 at 20 *lire* per 100	160 00
Canes, 6 000 at 5 *lire* per 100	300 00
Putting in place, 20 days at 6 *lire* per day	120 00
Dry pruning, 12 days at 6 *lire* (including gathering shoots)	72.00
Osiers, 60 kg at 0.40 *lire* per kg	24 00
Tying: 15 days at 4 *lire* per day	60.00
Pinching, 8 days at 7 *lire*	56.00
Working the earth, as in 2nd year	450 00
Copper sulphate and lime, 60 kg. each	159.00
Sulphur, 70 kg. at 110 *lire* per 100 kg.	77 00
5 sprayings, 10 days at 15 *lire* per day	150.00
3 sulphurings, 8 days at 7 *lire* par day	56.00
Harvest, 2 men at 15 *lire* + 5 women at 7 *lire* per day	65.00
Piquette: 89 days, 2 litres per day = 178 litres at 100 *lire* per hl	178 00
General costs as in 1st year	180.00
Interest or estimated expenditure 3641.50 *lire* at 6 $^{0}_{0}$	218.00
Total . . .	**3 860.00**

Yield in 3rd Year.

	Lire
Grapes, $^1/_4$ Normal yield, 18 quintals at 125 *lire* per quintal	2 250 00
Shoots, 200 bundles at 0.20 *lire* each	40.00
Total . . .	**2 290.00**

Final cost of the establishment.

First year 30 412 *lire* = 1.06	34 122.15
Second year 1 629 75 *lire* × 1.06	1 727.55
Third year 3 860.00 *lire*	3 860.00
Total . . .	**39.709 70**

The revenue lost from the land during these three years, should be added. Taking the value of a hectare ready to be sown at 15.000 lire at 3.5 $^{0}_{0}$, the profit is 525 lire; the accumulation of this profit for 3 years is therefore :—

$$525 \frac{(1.06)^3 - 1}{0.66} = 1671.40 \textit{ lire.}$$

The establishment cost at the end of the third year is therefore 39 709.70 + 1 671.40 × 41 381.10 *lire*, which after deducting receipts for the third year (2290 *lire*) = 39 091.10 *lire*. Therefore, with 5700 plants per hectare the cost per plant is 6.85 *lire* at the end of the third year.

Cost of amortisation and interest on the establishment cost. — Estimating the life of a vineyard at 35 years (32 plus the first 3 while it is being established) and ther ate of interest at 6 %; the rate of amortisation can therefore be reckoned by applying the following formula: —

$a = Awr \frac{1}{(1 + r)^{n - 1}}$, or $An = 39.091.10$ *lire*, $r = 0.60$ and $n = 32$, so that the rate of amortisation and interest is equal to 2 775.60 lire.

Annual cost of cultivation per hectare of vineyard.

Fertilisers: — Every 2 years, 5 quintals, superphosphate at 25 *lire* per quintal 1.5 quintals potassium carbonate at 55 *lire* per quintal, 1.5 quintal cyanamide at 100 *lire* per quintal, equal. every 2 years to 357.50 *lire*, or annually	178.75
Spreading the fertilisers, 4 days at 6 *lire*	24.00
Renewal of stakes 12 per annum at 6 *lire* each	36 00
Canes and stakes: 4270 canes at 5 *lire* per 100 + 200 stakes at 20 *lire* per 100.	253.50
Staking, 12 days at 6 *lire* per day.	72.00
Dry pruning, 20 days at 6 *lire* per day.	120.00
Gathering and cutting shoots, 5 days at 4 *lire* per day	20.00
2 hoeings, first 30 man days, second 25 man days at 12.50 *lire* per day.	687.50
Green pruning, 30 days at 7 *lire* per day	210.00
Copper sulphate, 75 kg. at 250 *lire* per 100 kg.	187.50
Lime, 75 kg. at 15 *lire* per 100 kg.	11.25
Sulphur: 100 kg. at 110 *lire* per 100 kg.	110.00
5 sprayings, total 13 days at 15 *lire* per day (the first at 12 *lire*)	190.00
3 sulphurwashes, 10 days at 7 *lire* per day	70.00
Thinning out, 10 days, at 7 *lire* per day	70 00
Harvest, 10 days (men) at 14 *lire*, 24 women at 7 *lire* per day.	368.00
Piquette: 114 days at 2 litres per day = 228 litres at 100 *lire* per hl.	228.00
General charges, as in the 3 first years.	180.00
Interest at 7 % for 6 months on general charges 3.100.00 *lire*	108.50
Rate of amortisation and interest on establishment cost	2 775.60
Profit on land investment, 15 000 *lire* at 3.5 %	525.00
Total	**6 509.60**
Subtract the sale of 500 bundles of shoots at 0.20 *lira* per bundle = 100 lire.	
Therefore the total cost of grape production per hectare = *Total*	**6 409.60**

As the vineyards are newly reconstituted with American vine an average crop can be expected of 70 quintals per hectare, which brings the cost of production of 1 quintal of grapes to 91.50 *lire*. Therefore it is desirable to limit vine-growing to those places where the natural, technical and economic conditions are such as will ensure a high, and if possible, constant yield.

PLANT DISEASES

GENERAL INFORMATION

96 – **Royal Decree of November 14, 1920. No. 1751 Regulating the Trade in Plants and Seed within the Kingdom of Italy.** — *Gazzetta Ufficiale del Regno d'Italia*, Year, 1920, No 303, pp. 4004-4005. Rome, December 24, 1920

Art. 1. — Living plants, or portions of such plants, with or without soil, and seeds intended for cultivation or reproduction, no matter of what kind, can be dispatched within the Kingdom by any means of transport, if provided with a permit granted by a delegate of the Ministry of Agriculture.

Art. 2. — The export is authorised from all parts of the Kingdom of living plants of every kind, except vines, coming from communes where phylloxera is known or suspected to exist, without the obligation of anti-phylloxera disinfection, provided the measures prescribed by the law of June 26, 1913, No. 888 (1) are duly carried ont.

Art. 3. — The permit made out in the terms of Art. 1. takes the place of the certificate of origin granted by the Mayor, for the despatch of plants of every kind, including the vine from communes immune from phylloxera. In these cases, no obligation is required as regards the packing.

Art. 4. — The permit granted under Art. 1 shall take the place of the preventive authorisation of the Ministry of Agriculture, and is a guarantee that disinfection has been carried out in the case of vines or portions of vines sent across immune communes from communes where phylloxera is known or suspected to exist, to similar communes. No regulation is established in this case as regards the nature of the packing, provided that it is disinfected at the same time as the vines.

Art. 5. — The provisions of the preceding articles do not apply to plants or seeds of any kind sent for examination to Phytopathological Institutes, Observatories, to Royal Inspectors of plant diseases, or to Laboratories entrusted with seed control.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

97 – **Java Sugar Cane Varieties Resistant to the "Sereh" Disease.** — See *R.*, No. 1083, Nov.-Dec. 1920.

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(1) A law prescribing measures for the prevention and control of plant diseases. Cf. *R.*, Aug, 1913, No. 995. (*Ed.*)

98 - **Change-over Tapping as a Means of Control Against Rubber Diseases, especially against Brown Blast.** — See No 54 of this *Review*.

99 - **Mosaic Disease of Maize in Porto Rico, Louisiana and Georgia.** — BRANDES, E. W., (Pathologist of Sugar Plant Investigations, Bureau of Plant Industry, United States of America) in *Journal of Agricultural Research*, Vol. XIX, No. 10, pp 517-521, pl. 2. Washington, D. C., Aug. 10, 1920.

In 1919-1920, the author observed maize affected by a disease similar to the mosaic disease of sugar in a field just west of Peñuelas (Porto Rico), in New Orleans (Louisiana) and near Cairo (Goergia). Others have reported a similar disease in the Hawaiian Islands and in Guam.

All varieties of maize are not affected to the same extent. In Louisiana, the White Creole variety while marked in some individuals was not excessive. The variety U. S. Select No. 182 is very susceptible to " mosaic," but is not especially injured by it. Golden Bantam appears to be immune.

The author is inclined to believe that in the United States no great damage has so far been done. Probably the disease was introduced on sugar cane within comparatively recent years, in which case it may become much more important in the future. Maize is almost invariably used in rotation of sugar cane land, so that no plantation is ever without maize in some of its fields. This means, of course, that the possibility for spread of the disease is greatly increased

In maize as in sugar cane, the most conspicuous symptom of mosaic is the streaked and irregularly mottled appearance of the leaves In maize, however, the lower, older leaves have a greater tendency to resume their normal colour. In the youngest leaves, either the normal dark green or the pallid affected tissue may predominate in a given specimen, but the latter condition is most frequently encountered. In such cases, the areas which remain normal are in the shape of broken or interrupted streaks or lines extending in the general direction of the long axis of the leaf, and the contrast in colour between these areas and the surrounding pallid areas is very decided. In most cases, the mosaic pattern is more prominent at the base of the leaf, where it diverges from the leaf sheath. Where the normal dark green is predominant, the light green affected tissue appears usually as a very fine mottling, or as irregular elongated streaks on the darker background From the foregoing description it can be seen that the patterns vary considerably, and yet they have certain general characteristics which make it almost impossible to confuse this condition with any other affecting the leaves.

Infected plants are always lighter in colour than healthy plants. In some cases, the colour becomes decidedly yellow ; a decided stunting of the whole plant then follows. No case has been observed to terminate fatally, but certainly considerable injury results from the lack of functioning chloroplastids, and where a large percentage of plants are affected, the loss due to decreased size of ears is appreciable.

When infection takes place early in the growing season, partial or complete sterility of the ears results. In some cases, plants affected have resumed their normal colour after several weeks.

Experiments have demonstrated that mosaic disease is dispersed through the medium of *Aphis maydis*, but there is no reason for supposing that transmission in nature is limited to this insect. It is not yet known whether the virus can survive the winter in seed, but experiments are now in progress that may throw some light on this phase of the problem. It has been proved that the virus of maize mosaic is identical with that of sugar and of sorghum, so that even if it is found not to be transmitted by the seed, perpetuation of the disease in the perennial grasses would explain its appearance on maize in the spring.

Control measures for this disease must be based fundamentally on the removal of sources of the infection. So far as is known, the only sources of infection are the living host plants. Destruction of these plants will, therefore, effectively eradicate the disease from any region. From the practical standpoint, the destruction of all affected host plants presents almost unsurmountable obstacles. The substitution of immune varieties of maize as well a sugar cane does not offer any immediate solution, since the most susceptible varieties happen to be the ones the most esteemed.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

100 - **Diminution in Respiratory Activity and in Metabolism Capacity of Wheat Plants attacked by Black Rust (*Puccinia graminis*).** — See No 24 of this *Review*)

101 - **The Over-Wintering of the Melanconia, *Marsonia Juglandis*, on the Branches and Shoots of the Walnut.** — PEYRONEL, B., in *Le Stazioni sperimentali agrarie italiane*, Vol LIII, Parts 4-6, pp 168-171 Modena, 1920

At Riclaretto, in the Waldensian Valleys (Province of Turin), in April, 1917, the author observed, upon the lower branches and shoots of certain walnut trees, concave patches that were nearly round, or more frequently elliptical, being a little elongated in the direction of the axis of the branch on which they were situated. The smallest of these patches were brown, the largest were whitish in the centre and brown round the periphery. Under a lens, minute block dots were seen on these patches; microscopic examination showed these to be the fructifications, in all stages of development, of *Marsonia Juglandis* (Lib.) Sacc., the conidial form of the ascomycete *Gnomomia Juglandis* (D. C.) Trav.

This conidial form is a common parasite of the walnut, but usually does it little injury. The fructifications are often found on the fruits, as well as on the leaves, but very rarely occur on the branches. The tissues beneath the patches are affected by necrosis and are blackened and isolated by a layer of phellosan which continues for some distance, and makes its way toward the surface, beyond the concavity in a zone which, to all appearance, is healthy.

The fungus was in full vigour, and seemed capable of propagating and carrying the disease to other leaves.

There is only one possible explanation of the presence of the patches on these organs at the date mentioned above. During the previous autumn, the tree was severely attacked by *Marsonia*, and the fungus extended from the leaves to the more tender branches, and especially to the young shoots which were not yet lignified. As soon as winter set in, the fungus stopped growing, and its fructifications remained during the cold season at about the same stage of development which they had attained in the autumn.

M. Juglandis is therefore able to over-winter also in the conidial form, at all events on the branches and shoots of the walnut. It would, however, be advisable in cases of severe attack to keep these organs of the tree under observation, and to cut them off as soon as the characteristic fungus patches make their appearance, all the more, seeing they must form excellent centres of infection in the spring, when the frequent rain transports the conidia, depositing them on the young tender leaves

102 – **Resistance to Rust of Various Types of Wheat.** — See No. 30 of this *Review*.

103 – **Resistance of Certain Trees to Diseases and Insect Pests due to Hybridisation.** — See No 40 of this *Review*.

104 – **The Take-all or Foot-rot Disease of Wheat (*Ophiobolus graminis*) in New York State** (1). — KIRBY, R. ., and THOMAS, H. E., in *Science*, new series. Vol LII, No. 1346, pp. 368-369. Lancaster, Pa., Oct. 15, 1920.

Early in July 1920, a at East Rochester, New York, attention was attracted to a small area in a field of soft red winter wheat, where the plants were baldy dwarfed and prematurely dead. In many cases secondary culms had been killed soon after their formation. The roots of the plants were rotted and usually broken near the base of the culm: the lower internodes were dark or entirely blackened and enveloped by a dense sheath-like plate of thick-walled brown mycelium. This plate was formed between the leaf sheath and culm, Perithicia in considerable numbers were found embedded in the leaf sheath and mycelial plate. Microscopic measurements of these and ascospores agree very closely with those given by SACCARDO for *Ophiobolus graminis*.

As soon as the fungus was identified, steps were taken to determine the source of the infection and to completely eradicate the disease from the infected area.

105 – **Gumming Disease (*Bacterium vascularum*) of Sugar Cane in Porto Rico.** — MATZ, J., in *Phytopathology*, Vol. X, No. 9, pp. 429-430, figs. 1. Baltimore, M. D., Sept., 1920.

Gumming disease of sugar cane is known to have occurred in Australia (New South Wales and Queensland), Fiji Islands, Mauritius, Java, Borneo. New Guinea, Brazil, and very likely in Tucuman, Argentina. There is, no record of it in the West Indies. The disease apparently does not occur in India.

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(1) See also *R.*, April, 1920, No. 470. (*Ed.*)

In February, 1920, gumming of sugar cane was identified by the author in two car loads of cane from the Trujillo Alto district, Porto Rico. The gummy exudation (varying in colour from a lemon-yellow to the colour of honey), at the cut ends of the cane stalk, together with the bright red vascular bundles in the canes in more advanced stages of the disease, are symptoms that agree with the gumming of cane in Australia as described by COBB and studied by E. F. SMITH. Masses of the bacterium in pure culture were smeared on needle-pricked surfaces of leaves of 10 healthy young "Otaheite" canes in an isolated greenhouse. After 3 months from inoculation all these plants showed, when cut, typical gummy exudation from the fibro-vascular bundles.

Immediately upon the recognition of the fact that gumming disease exists unmistakably in Porto Rico, a special survey was made of all the principal sugar cane growing centres, and it was found that the disease is not widespread and the exact locations of its occurrence are only in the Trujillo Alto district in the area of about 15 km. Specimens of the diseased cane were shown to men who have planted cane for many years, but all were unanimous in declaring it a new thing. One planter alone, stated that he had noticed it to a very limited extent the previous year.

The disease occurs in localities where no new introductions of seed have been made for many years past, and it was found in the oldest varieties grown on the island, namely, "Otaheite," "Rayada," "Crystallina" and "Cavengerie" or "Colorada". The Otaheite is the most severely attacked, while the "Cavengerie" is the least attacked. It seems very likely that the disease has been in existance in the island for some time past in insignificant proportions, but the unusually heavy rains at the beginning of 1920 have very probably aided the spread thereof by taking on the form of an epidemic in one district where Otaheite is usually grown. Whether the disease will subside with the advent of the normal rainfall remains to be seen.

The only safe way to check the spread of the disease is through the planting of resistant varieties. The disease has not been observed in the variety "Yellow Caledonia." The fact that "Rayada" is susceptible makes it rather a difficult problem as this variety is largely grown all over the island. "Cavengerie" shows decided resistance but it is not a very desirable variety from the industrial standpoint.

106 - **Diseases and Pests of Hairy Vetch in the United States.** — See No 48 of this *Review*

107 - **Tomato Diseases in Victoria, Australia.** — BRITTLEBANK, C. C., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XVIII, Pt. 7, pp 413-416. Melbourn, July, 1920.

A brief survey of the tomato diseases which occur in Victoria, followed by a description of the control measures employed. The diseases mentioned are:

(1) Bacterial wilt (*Bacillus Solanacearum*).

(2) Irish potato blight (*Phytophthora infestans*) in the drier portions of Victoria this disease has not caused any considerable loss to tomato growers. Besides the potato and the tomato, a native solanum, *Solanum aviculare* has contracted the disease:

(3) Wilt or "sleepy disease" (*Fusarium Lycopersici*) this has not yet caused any marked loss in those districts of the State most suited to tomato culture.

(4) Target spot (*Alternaria Solani*): important.

(5) Root Rot (*Rhizoctonia Solani*): one of the most destructive seed bed troubles and very common round the suburbs of Melbourne.

(6) Damping off disease (*Pythium de Baryanum*).

108 - **Notes on Spotting of Apples in Great Britain** (1). — Horne, A. S., and Horne, E. V. (Dept. of Plant Physiology and Pathology, Imperial College of Science and Tecnology), in *The Gardener's Chronicle*, Vol. LXVIII, 3rd series, No. 1766, pp. 216-217, figs. 4. London, Oct. 30, 1920.

During the past few years reports of "spotting" in apples in England have been frequently notified, and cultivators have made insistent enquiries as to the cause of the trouble and the remedies likely to prove serviceable in mitigating the same.

Several instances are recorded of the sudden appearance and rapid development of spotting in stores, causing disfigurement of the fruit and greatly prejudicing its sale.

In some varieties, the spots remain small, although they are frequently very numerous (as many as 200 have been counted in individual specimens); in others they grow large and the apples affected decay early in the season.

"Spotting" has been reported from the countres of Berkshire, Cambridgeshire, Kent, Middlesex, Oxfordshire, Surrey, Sussex and Worcestershire, and appears to have spread generally throughout the apple growing districts. It is first observable in orchards towards the end of July and in early August. The spots which are round or of a more irregular outline and are sometimes sunken, forming shallow pits, are usually scattered promiscuously over the surface of the apple. In colour they are dark green, rose, purple or brown.

The varieties attacked are numerous, including many of the well known culinary sorts: Lane's Prince Albert, Dumelow's Seedling (Wellington), Pott's Seedling. Newton wonder, Bramley's Seedling, Ecklinville Seedling, and Peasgood's Nonsuch; and many notable dessert sorts, such as Cox's Orange Pippin and Allington Pippin.

The varieties which escape, include the russets: Christmas Pearmain, Worcester Pearmain, the late pippins:— Allen's Everlasting, Fearn's Pippin, etc.; and Barnack Beaty, Gloria Mundi and Belle Dubois.

A species of *Pleospora* (*Pl. pomorum*) (which is capable of ~~acting as~~ a casual organism), has been discovered and isolated from at least 20 varieties of apples. Several varieties developed spotting as a result of artificial inoculations. In at least 3 sorts — Allington Pippin, Rival and Wealthy, rotting ensued which was directly caused by *Pl. pomorum*.

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(1) See *R.*, Nov.-Dec., 1920, No. 1193. (*Ed.*)

Pl. pomorum is, however, believed to be not the only fungus capable of causing " spotting ". Several other fungi have been isolated, but their rôle has not yet been ascertained. These include *Alternaria Grossulariae* and *A. pomicola*.

Several new fungi have been identified as attacking apples (1) of which the most noteworthy is *Polyopeus purpureus*. This fungus has been obtained from at least 20 sorts of apples, and it is considered probable that it is a casual organism. In addition to this, *Leptosphaeria vagabunda*, prevalent in America on twigs of different trees, and *Coryneum folliicolum* said to cause cankers on twigs and branches of American apples, have been obtained.

From the very frequent occurrence of spots at the lenticels, there is every probability that the infection by fungous organism takes place at the lenticel

As regards control measures the following rules should be observed : —

(1) Winter spraying, preferably towards the end of December with 1 % Burgundy mixture ;

(2) Winter spraying of interplanted trees and bush fruits. It is known that certain fungous organisms spread to the apple from other host plants, *e. g.* the *Alternaria grossulariae* from gooseberries to apples ;

(3) General sanitation : — as the fungi which cause disease in fruit trees are able to exist in dead wood and leaves, decaying fruit, cankered twigs and branches, and in untreated wounds of various kinds.

(4) Summer spraying : — as spotting shows itself first towards the end of July, a single spraying with a one-half per cent. Burgundy mixture, during early July should prove an effective direct method of prevention ;

(5) Insect control : — it is believed that the infection of apples is brought about to a great extent through the agency of mites and other small insects ;

(6) Store sanitation :— the store room should be systematically disinfected and fumigated ;

(7) Since the fungi concerned in " spotting " grow very slowly at low temperatures (0°C to 5°C), some system of cold storage combined with store sanitation is recommended. This is very necessary where apples subject to attack are stored after gathering from trees not previously sprayed.

109 - ***Spirospora Castaneae* n. gen. and n. sp., a Deuteromycete found on Chestnuts in France.** — MANGIN, L. and VINCENS, J, in the *Bulletin trimestriel de la Société mycologique de France*, Vol. XXXVI, Part 2, pp. 89-97, figs. 7 Paris, 1920

The examination of chestnuts attacked by black rot (2) has revealed the presence of other, and rarer, micromycetes, among which is a new genus of Denteromycetes (*Spirospora*), represented by a single species to which the authors have given the name of *Spir. Castaneae.*

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(1) See *R.* Nov.-Dec. 1929. No. 1193. (*Ed.*)

(2) See *R.*, July Sept., 1919, No. 1042. (*Ed*)

The pulp of the chestnuts was altered and yellow ; part of the surface of the seed-coat beneath the pericarp of the achene, was covered with an efflorescence of a chocolate-brown colour ; this the microscope showed to be wholly composed of large, characteristic multicellular spores.

The authors describe the formation in artificial cultures of these spores and the accessory conidia, as well as that of simple sclerotia or of perithecia, the characters of the mycelium, and the germination of the spores. Finally they give a detailed description of the genus *Spirospora* (which is closely related to the genus *Mycogone*) and of the species *Spir. Castanae.*

110 - ***Phomopsis Pseudotsugae* n. sp., Deuteromycete Parasitic on the Douglas Fir (*Pseudotsuga Douglasii*), in Scotland.** — WILSON, M., in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXXIV. Pt. 2, pp. 145-149, pl. 2. Edinburgh, 1920.

More than 10 years ago attention was directed in Scotland, to specimens of the Douglas Fir, *Pseudotsuga Douglasii*, from 6-10 years old in which the leading shoot had been killed for a distance of 6-12 inches behind the apex. Examination of the damaged portions led to the belief that the injuries could not be attributed to frost.

Some years later, other similar specimens were collected, and on the dead shoots the fructifications of a species of *Phoma* were noted. During the last 18 months, numerous specimens have been obtained and examination has shown that the disease is undoubtedly caused by a species of *Phomopsis*. The specimens attacked were received from several localities in Perthshire, from near Forres, and from Argyllshire, Dumfries and Inverness, and it may be concluded that the disease is widely spread in Scotland. Trees are attacked up to about 10 years old both in nursery stock and in plantations.

Two types of attack may be distinguished. In the first, the leading shoot (or occasionally a side shoot) is killed back for a variable distance, usually about 9 inches. In the second, the young tree is attacked a short distance above the ground-level, the outer tissues are killed on one side only or completely round the stem, and ultimately the whole tree is destroyed. In both cases, a very characteristic feature of the disease is the sudden decrease in diameter in passing from the healthy to the diseased portion of the stem, and this is very marked in the second method of attack described above, where the stem immediately above the diseased portion is abnormally increased in thickness. Numerous resin blisters are developed on the stem both above and below the point of attack, and after these have burst, the whitish patches of dried resin are very obvious.

Some time after the stem is attacked, minute black fungus fructifications appear in large numbers on the dead portion and in some cases on the dead leaves. These are at first covered, but are later on exposed by the splitting of the bark and finally project slightly above the surface.

They contain very minute spores which, in damp weather exude from the fructifications in mucilaginous filaments or masses of whitish translucent appearance.

The fungus found in Scotland on *Ps. Douglasii* is believed to be a new species and is designated here as *Phomopsis Pseudotsugae.*

A plantation of *Ps. Douglasii* in Perthshire about 6 to 8 years old, was examined in April 1920, and it was estimated that half of the trees had been killed by the disease. The dead trees were removed and burnt and the spaces were replanted with fresh trees. In September about 20 % of the trees were showing signs of attack, and these included some of those planted in the previous April. The method and time of attack are not yet fully known.

Ripe spores capable of germination, have been collected in April and October, and it is probable the infection takes place during the summer. In all probability the species is a wound parasite, this must certainly be the case where the main stem of plants 4 to 8 years old, is directly attacked not much above ground-level, although it is possible that young uninjured shoots may become infected.

The narrowing of the stem in the infected portion is the result of the death of the cambium and consequent stoppage of secondary thickening. Probably some considerable time elapses between infection and death of the cambium. In the case of a tree 6 to 8 years old infected near the base, secondary thickening of the infected portion probably ceases about a year after infection when the leaves begin to turn yellow ; death probably takes place during the following winter. In a tree in which the leading shoot is infected near the apex, growth continues during the following summer and death of the shoot takes place in the winter. Fructifications of the fungus are often found all over the dead trees, and it is evident that the fungus can live on as a saprophyte afterwards.

Owing to the long period which elapses between infection and the first obvious signs of disease, it is possible that the latter may be distributed by the nursery stock which is apparently healthy, although really diseased.

Young plantations should be carefully examined for trees showing early signs of the disease, and these should be removed and burnt.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

111 - ***Athene brama,* The Spotted Owlet Useful in Agriculture in India.** — FLETCHER, T. B., and INGLIS, C. M., in *The Agricultural Journal of India,* Vol. XV, Pt. 3, pp. 235-238 + 1 pl. Calcutta, May, 1920.

The Spotted Owlet (*Athene brama*) occurs abundantly throughout the Plains of India and Burma, although not found in Ceylon. It is in evidence during the evening and is quite a domestic owl. It is one of the birds that hawks white ants, and is a great bat hunter, but apparently this habit is perhaps local or confined to a few individuals. It lives chiefly on insects and to a less extent on mice, shrews and lizards etc., its insect prey consisting mostly of beetles and crickets. In the case of 8 birds examined at Pusa, of 69 insects taken, one was of a useful species, 26 were neutral and 42 were injurious A case is mentioned, in which a pair of *A. brama* had apparently killed a nesting paroquet (*P. torquatus*), and taken possession of the nest for themselves. As *P. torquatus* is a distinct nuisance to the agriculturist it is wished that *A. brama* would act regularly in this way.

At Pusa, this owlet seems to live chiefly on large crickets (*Brachytrypes* and *Gryllotalpa*) and on dung-beetles. There is no doubt that it is a most useful bird in all districts where large crickets occur so commonly as to do damage. As these crickets are nocturnal, their most effective natural enemies are those, such as *A. brama*, which are also nocturnal.

A. brama breeds from February to April, slightly earlier in the south and later in Northern India, but the greater majority of birds lay in March.

112 - Means Adopted in Crau for the Control of the Moroccan Cricket (*Dociostaurus maroccanus*) in 1920. — VAYSSIÈRE, P., — Communicated by M. LOUIS DOP, Delegate of France.

As the Moroccan cricket (*Dociostaurus maroccanus*), has multiplied to such an alarming extent since 1917 as to threaten the existence, not only of the crops growing in the plain of Crau, but also of those in the neighbouring regions, a systematic campaign was organised in the spring of 1920 with the object of checking the increase of this pest.

The course of the invasion of 1917 to 1920, the work during the previous campaign, and the biological observations made, are the subject of a complete report which will appear subsequently. It, however, seemed desirable to describe the measures adopted for the destruction of the crickets during their various stages, and the results that have been obtained.

The control operations were organised under the direction of a " Defence Syndicate " (Syndicat de défense) which adopted flame-throwers, poisoned baits, chloropicrin solution, and collection on sheets.

The necessary staff for carrying out these measures was furnished by the War Ministry, and the economic importance, of the undertaking being fully recognised, a certain number of soldiers were specially instructed in the use of flame-throwers (Army model P3). Towards the end of May, in spite of difficulties connected with the condition of the country, the XVth C. A. supplied nearly 250 men belonging to the corps and provided with 60 flame-throwers with their accessories (bottles of compressed air, fuses, etc. On the other hand, thanks to the assistance of the Services interested) both military and civil, and especially of the P. L. M. Co. (in transport, it was possible to procure, though sometimes unfortunately, not as soon as was desired, all the products necessary for initiating the campaign.

In order to carry out this task satisfactorily, the military contingent was divided into gangs, each containing from 6 to 10 men. These were distributed in the " Mas," where they were billeted on the agriculturists, who were to recompense them according to the services rendered. As occasion arose, these gangs were transported on motor-lorries (lent by the military authorities) together with all their appliances, which at first consisted of 4 flame-throwers with accessories, 24 bottles of compressed air, 50 fuses, 1 barrel of heavy oil, 100 kg., of bran, 5 kg., arsenious acid, 5 kg., salt, 20 kg., molasses, and 1 sheet for collecting the insects when beaten down.

(1) *Flame-throwers.* — From the experiments carried out in 1919 by M. BAZILE, in which the author also took part, it seemed that the control of crickets should be based upon the rational and systematic use of these implements of war. Details will not be repeated here that have already been published (1), but it suffices to say that the surface cleared by a single charge of a P3 flame-thrower (13 litres) is nearer 500 sq. m., than 200 sq. m., as previously given. Further, the best results were obtained by directing only one or two flame-throwers on the same spot. Experience has indeed shown that 3 operators placed 3 to 4 metres apart in front of a column of crickets hinder one another, and owing to the large amount of smoke liberated, run the risk of seriously injuring their comrades by means of the flame. Also, as a rule the various flame throwers differ in length of flame-jet, combustion of fuse, etc., which entails difference in the progress of the operators.

Excellent results were obtained by the following method:— 4 or 5 men provided with branches or sacking slowly beat down the crickets towards a certain point, in order greatly to increase their concentration at that spot. This operation, if well directed, is easily effected, even in the case of the winged insects. When it is concluded, the beaters retire, and a flame-thrower, after taking in the situation at a glance, can in a few seconds, calmly and quickly (this is soon learnt by practice), sweep all the surface covered by the insects.

Under such conditions, the whole charge can be completely exhausted in two minutes (including loss of time due to change of position by the operator, in order to ensure greater efficacy), and in 15 jets of flame. It is, however, not necessary to empty the flame-thrower at one time. It is indeed indispensable that the operator should stop (for instance, at the word of command), when his work is not needed. Therefore, someone must always be at hand in order when required, to turn off the air-tap, while the operator extinguishes his fuse.

It can easily be understood that in an operation such as just been described, two or three flame-throwers stationed in front of a column of crickets would interfere with one another on changing position, and that it is necessary to reach the insects before they are dispersed by the confusion due to the first flame-jets

The use of several flame-throwers at a time is, however, not to be rejected, especially in combating columns of young crickets often only

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(1) See *R.* July-Sept. 1919, No. 1049; *R.* Jan. 1920, No. 147. (*Ed*)

4 to 6 m. wide, but extending for several hundred metres. Then, two flame-throwers with similar appliances, if placed in front, and advancing at the same pace for 20 metres, can obtain excellent results.

Finally it may be said that the use of single or massed flame-throwers is a question that must be decided at the time, and it is only possible to make some suggestions on the subject.

(2) *Poisoned baits.* – This control method was first applied in the case of irrigated crops, and was subsequently extended as circumstances required to all ground invaded by crickets. As time was then devoted entirely to practical work, not to experiment, no attempt was made to find new poisoned bait formulae, but use was made of those already studied in 1919, and of which the mode of use has been given in a preceding Report (1).

Owing to the excessive cost of oranges and lemons, at the end of a few days, these fruits had to be omitted from the arsenical mixture which, however, did not seem to detract in any way from its efficacy. The following is the recipe handed to all the gangs entrusted with the preparation of the paste:

I.	Bran	10 to 12	kg.
	Salt	0.500	»
	Arsenious acid	0.500	»

Mix these three substances very thoroughly before adding the solution, which should have been previously made up.

II.	Water	2	litres
	Molasses	2	»

Mix again very thoroughly, so that all the bran is completely impregnated with the liquid. Should the mixture be too dry, add a little water (one or two litres at most).

The bait should not be prepared save at moment of using it (at night fall, or before in the morning). Spread the bran broad-cast over the irrigated crops. Take all precautions necessary in handling very poisonous substances such as washing the hands well after the operation. A mask should be used when making mixture I.

The bait was spread before the insects become active in the morning, or else at night fall. The results seem to be the same in either case. They one indispensable condition for obtaining a good bait, however, is that the various ingredients should be as thoroughly mixed as possible. In this case it was mixed by hand, especially as any given gang seldom prepared more than 100 kg., of poisoned bait a day. In places however, such as Africa, where the swarms of locusts are larger, but less numerous, it would be advisable to have special mixing-machines, such as ratus devised by G. PAOLI in Italy (1). Use could also be made of a barrel turning on a horizontal axis, such as was recommended for the preparation of poisoned grain in the control of field mice in the liberated regions (1).

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(1) Cf. P. VAYSSIÈRE, Les sauterelles dans le Sud-Est de la France en 1918, *Ann. Serv. Epiph.*, VI, p. 289. Paris, 1919.

The amount of bran spread per hectare was variable, but an average of 30 to 60 kg., according to the size of the column, is about right.

The toxic action of the mixture is shown even the next day, when already some dead insects are seen, whilst many more are unable to fly and drag themselves along or lie on one side. The excrement is blackish and liquid. The maximum mortality appears to occur on the third day, but not infrequently the bait retains its toxic properties for a fortnight. The insects collect at the foot of plants, or to be more exact, most of them are found beneath the trees or plants upon which they have passed the night. According to the few calculations effected, the average number of dead crickets per 59 metres was about 600. In certain cases, however, only 200 could be counted, although in others, the number was 1000 or more, which would mean some 10 000 000 insects per hectare. This remedy is obviously most efficacious, and should be used in France against pests like grasshoppers.

(3) *Chloropicrin solutions.* — As excellent results had been obtained with these during the experiments made in 1919, it was hoped that they could be used on a large scale in combating crickets. Unhappily, owing to circumstances over which the author had no control, he was unable to obtain the necessary products at the right time, or to use them under the best conditions. However, 500 kg., of chloropicrin was employed in a soap solution which gave most satisfactory results in the proportions by weight of 2 parts of coconut oil soap ; 10 of chloropicrin : 100 of water.

(4) *Collecting the crickets on a sheet.* — This method was chiefly used when it was urgently necessary to meet the difficulties due to want of labour and especially of heavy tar oil which, on account of the strikes, was no longer supplied us by the factories. By the use of collecting sheets, 2000 to 5000 crickets were collected daily in the whole of Crau during one month. The insects thus captured were in the 4th and 5th stages.

To sum up, the use of the control methods described made it possible considerably to minimise the bad effects of the abnormal multiplication of the Moroccan cricket in Crau during the spring of 1920. The efforts of the Defence Syndicate were all the more praiseworthy sceeing that, at certain moments the success of the campaign against the crickets was extremely problematic, owing to numerous difficulties of a general character

113 – **Industrial Utilisation of Locusts vith a View to their Ultimate Destruction.** — [illegible] of this *Review*.

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(1) See *R.*, Jan., 1920, No. 146. (*Ed.*)

(1) See *R.*, Mar., 1920, No. 378. (*Ed.*)

114 - **Destruction of Termites by Means of Chloropicrin** (1). — FEYTAUD J., in the *Comptes rendus hebdomadaires des seances de l'Académie des Sciences*, 1920, Second Half-Year, Vol CXLXI, No 8 (August, 23, 1920), pp 440-442 Paris, 1920

Laboratory experiments made by treating with chloropicrin vapour fragments of infected pine-tree trunks placed under large bell-jars have proved that chloropicrin vapour is very effective against *Leucotermes lucifugus* Rossi. At a temperature of 20° C., 2 mgm, of chloropicrin per litre was sufficient, with 12 hour's exposure, and 5 mgm., with 6 hours, to destroy all the termites, both those set free within the bell-glass, and any living at a depth of 10 cm. in the pieces of wood

The effect of the chloropicrin upon the termites is first shown by the insects becoming restless and agitated; they crowd towards the interior of the galleries, which explains the accumulation of dead and dying ants and the confusion reigning in these passages. Then there supervenes a condition of paralysis that passes quickly into death, if the action of the vapour be continued for some hours, though otherwise it may last for several days, but in no case do the ants recover.

In order to destroy a colony of *L. lucifugus*, it is thus not necessary to kill all the individuals by the treatment, provided they are all paralysed Nevertheless, with a view to being more certain of the effect produced, and to overcoming the difficulty of penetrating into the wood which increases in proportion to the thickness of the latter, the author tried, as far as possible, to give the doses and exposure that caused the instantaneous death of the insects under the bell-jar. Thus, in his experiments on trunks covered with tarpaulin, and on pieces of beams in a small room. he took as his basis the minimum exposure of 12 hours in an atmosphere containing 10 mgm., of chloropicrin per litre; under these conditions, the results were excellent.

The practical application of his method in a villa at Saint-Jean-de-Luz (Basses Pyrénées), consisting of a ground-floor, and two other storeys, confirmed the results of the experiments made in the laboratory.

We have therefore every reason to hope for excellent results in the use of chloropicrin for the disinfection of houses infested by termites. If applied with the necessary precautions, and in the manner adapted to each case this process has shown itself to be easy and free from all risk.

115 - **Disinfection of Cotton Seed by Means of Dry Heat.** — SCHRIBAUX, E., in *L'Agronomie Coloniale*, Year V, No 34, pp 103-104 Rochefort-Paris, October, 1920

In the course of experiments undertaken for the purpose of determining the action of dry heat in freeing cotton-seeds from animal parasites, two different lots of the seed of this Malvaceae were subjected to rising temperatures of 60° C, 65° C., 70° C. and 75° C. for one two, and three hours.

It was shown by these experiments that, up to 70° C., the vitality of the seeds treated for a time varying from one to three hours was in no-wise impaired; at 75° C, the seeds nearly all died after two hour's treatment, or else produced yellow, sickly seedlings According to the author, a temperature of 60° C. is enough to destroy all the animal parasites of the cotton plant.

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(1) See also *R.*, June, 1920. No. 705 (*Ed*)

Given the small amount of cotton seed used per hectare, it is not necessary to employ a costly apparatus, all that is required is to mix the seeds with very fine dry sand, or sawdust, previously heated in a large caldron to the temperature of 60° C. A few preliminary experiments will show how much must be used under the given conditions so that the mass can be kept at 60° C. for at least one or two hours.

116 – **Insects Injurious to Artichokes in Italy.** — See No 60 of this *Rev.*

117 – ***Targionia merrilli*** **n. sp. Coccid Observed on** ***Rhizophora mucronata*****, in the Philippines.** — Cockerell, T D A, in *The Philippine Journal of Science*, Vol XV, No 1, pp 385-387, fig 1 Manila, 1919

Description of the new species *Targonia Merrilli* found on the upper and lower surfaces of the leaves of *Rhizophora mucronata* Lamarck, in Manila (Philippines) in September 1918

[115-117]

ALFREDO RUGGERI, gerente responsabile

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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

118 - **The Natural Control of Anopheles Larvae by Means of Aquatic Insects.**— FEDERICI, E, in *Atti della R. Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol XXIX, Parts 3-6, pp. 170-173, Parts 7-8, pp. 224-247, Second Half year. Rome, 1920.

The larval forms of Libellulidae and Dityscidae, as well as certain adult Coleoptera and Rhynchots, which are known to be very voracious and to prey upon other aquatic insects, have been suggested, in a general way, as probable destroyers of anopheles. The author has tested this assertion by the help of laboratory experiments, using different groups of the insects representing the fresh-water entomofauna of Italy, and anopheles during the larval and adult stages. He discovered the following facts.

Anopheles larvae are very well protected by their peculiar conditions of life, and especially by the fact that they nearly always assume a horizontal position on the surface of the water and in the immediate neighbourhood of floating plants. This greatly reduces the number of predatory insects that may be regarded as more or less contributing to the destruction of the anopheles. Of these predatory insects, those that wage most successful war against the pests are: among the rhynchota, the genera *Naucoris, Notonecta, Corisa* (larvae and adults), either on account of their relatively large size, or because of their number and voracity; among the Pseudoneuroptera, the larvae of the genera *Aeschna, Anax, Calopteryx, Gomphus, Agrion, Lestes* and other similar insects, but these are less formidable foes and probably only destroy the anopheles larvae in shallow ponds, where, these is a large amount of submerged vegetation at a short distance from the surface.

The destructive effect of these predatory insects seems to be of little actual practical importance.

119 - **Importance of Lupins as a Food.** — I. Baut Lupinen ! in *Deutsche Landw. Presse*, No 18, p 140. Berlin, 1920 — II KONIGSDORF, F , Zur Verwertung der Lupinen zu tierischer und menschlicher Ernahrung, *Ibid.*, Nos. 24-25, p. 187. — III. GERLACH and LUECKE, Vergleichende Versuche uber die Entbitterung der Lupinen in Grossbetrieb (Mitteilung des Vereins zur Hebung des Lupinenbaues), in the *Illustrierte Landw. Zeitung*, Nos. 101-102, pp. 437-438, 1920 — IV. MULLER and PRIESHOF (Direktor und Tierzucht-Inspektor, Ruhlsdorf, Kreis Teltow), Erfahrungen mit Lupinenfütterung an Schweinen, in the *Deutsche Landw Presse*, No 96, pp 654-655, 1920.

I. — LUPIN CULTIVATION. — Baron VON WANGENHEIM, president of the " Verein zur Hebung des Lupinbaues " (Association for promoting lupin cultivation in Germany), has started an active propaganda on the dangers of the want of cultivation through lack of fertilisers and proper attention. The first advice that he gives concerning uncultivation and increased food production is to cultivate seed lupins, especially where the cultivation of summer cereals and hoed crops is impossible. The ancient Romans knew how to attenuate the bitter taste of lupins and make them into a food in common use.

The difficult food situation in Germany and the disastrous change it has undergone are sufficient reasons for advising the extension of lupin cultivation.

II. — USE OF LUPINS AS FOOD FOR ANIMALS AND HUMAN BEINGS. — According to M. H. VON FEHRENTEIL, 3 kg. of crushed lupin is equal as regards food value to 10 kg. of oats. In Germany there are 12 million Morgen (3 063 600 hectares) of sandy soil until now untouched which could grow lupins for seed, followed by barley or potatoes; estimating the average yield at 350 kg. per morgen (1332 kg. per hectare), 120 million quintals equivalents to oats could be obtained.

Lupins deprived of their bitter taste and mixed with potatoes and dried carrots, form an excellent food for animals. The water in which the lupins are soaked to remove the taste makes a better fertiliser than night-soil. Dough making, fermenting and cooking tests of flours containing 10-20 % of lupin flour have given satisfactory results.

III. — COMPARATIVE TESTS OF METHODS OF REMOVING THE BITTER TASTE FROM LUPINS ON A LARGE SCALE. — During the summer of 1920 the authors carried out numerous experiments on this subject at the Janikow starch-factory, in Pomerania, at the request of the " Association for encouraging lupin cultivation ".

Four industrial methods were tried. — That of KELLNER-LÖHNERT using boiling water ; that of BACKHAUS (patented), using potash lye ; that of BERGELL (also patented), using common salt ; that of THOMS, using hydrochloric acid. The lupins were mixed (yellow and blue species) and were partly mouldy and damp. The whole mass (1000 quintals) was dried at once and 250 quintals taken for the tests (25 quintals per test).

In the first series of experiments, the best results were given by the THOMS process, with which the residual content of alkaloids of the de-bittered lupins when dried was 0.029 %, whereas with the other three processes it was more, being 0.1 %, which was taken as the maximum limit of tolerance.

The operation was improved during a second series of experiments, however, and the lupins sweetened and dried to the same degree had the following percentage composition:

Composetion	Original lupines bitter	Sweetened lupines			
		KELLNER-LÖHNERT	BERGELL	THOMS	BACKHAUS
	%	%	%	%	%
Moisture	13 19	10.00	10 00	10.00	10.00
Crude protein	41.76	42.82	38.64	41.40	42.62
Crude fats extracts	4.92	4.05	3.17	3 54	3.16
N., free extracts	22.41	23.38	25.72	24.85	24.53
Cellulose	13.47	16.36	17 67	17.79	15.54
Ash	4.25	3.39	4 80	2.42	4.15
	100.00	100.00	100.00	100 00	100.00
Pure albumin	37.86	41.87	36.75	40.01	41.65
Non digestible albumin	2.14	7.52	8.13	8 80	5.90
Alkaloids	0.779	0.110	0.045	0.039	0.065

It follows, therefore that the process least suited for bittering lupins on a large scale is the KELLNER-LÖHNERT (1); but the authors do not doubt that a more prolonged treatment with lye will produce the desired sweetness. Two facts merit special attention with regard to these processes:— The loss of 17 % (BACKHAUS) to 22 % (BERGELL) of dry matter in the sweetened lupins, compared with untreated lupins; and the decreased digestibility of the albuminoids. The first disadvantage is inevitable, but the second can be attenuated by modifying the method of drying the sweetened lupins; the authors intend to deal with this question elsewhere.

In spite of these losses, lupins constitute an excellent food for man and beast, the economic value, however, is governed by the price of the bitter lupins, which depends entirely on the extent over which they are cultivated.

IV. — Hitherto lupin seed has been little used as food for pigs; few experiments have been made and the information is very vague concerning the rations and the production of meat.

At the pig-breeding Station at Ruhlsdorf, the authors carried out feeding trials for 4 weeks with pigs of all ages fed on lupins.

The fattening ration was potatoes, lupins, and salt. On October 6, 1920, a group of 8 pigs, 8 months old, and weighing 60 kg. each, was made. For some time before the experiment, those animals that were accustomed to pasturage, received a supplement of lupins which they accepted immediately.

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(1) M. KELLNER recommends the boiling-water process as more simple and preferable. *Cfr.* O. KELLNER, *Die Ernährung der landw. Nutztiere.* Parey, Berlin, 1916, p. 278. (*Ed.*).

The lupins of the yellow variety were softened for 12 hours in hot water in a special steamer, then steamed for 1 hour and then washed for 24 hours in several changes of water

Reduced to a fine paste the sweetened lupins were mixed with potatoes that had also been steamed; the cold mixture was given to the pigs *ad lib.*

During the experiment the daily consumption averaged 13.4 kg. per head, *i. e.*, 11.23 kg. potatoes and 2.17 kg. soaked lupins, corresponding to 806 gm. of sweet air-dried lupins (humidity 14 %). The average increase in live weight per day per head was 916 gm., so that the production of 1 kg. of live weight corresponded to 0.879 kg. of sweetened, air-dried lupins and 12 kg. of potatoes.

The extraordinarily favorable result of the first period of the experiment (the authors have begun a second one on fattening), suggests that the pigs can be fed on further quantities of this mixture until fat with advantageous results and without danger to their health.

120 – **The Globulin of the Cohune Nut** ***Attalea Cohune.*** — JOHNS, C. O and GERSDORFF, C. E. F. (Protein Investigation Laboratory, Bureau of Chemistry, United States Department of Agriculture Washington), in *The Journal of Biological Chemistry*, Vol XLV, No. 1, pp. 57-67 Tables 12, Pl 1, bibliogr of 12 works. Baltimore, M D December, 1920.

This nut was not commercially exploited until the war, when the shells were carbonised and used in gas masks, the kernels being pressed for their oil, which is of a very high quality and is similar to coconut oil. Experiments are now in progress in British Honduras, (the cohune palm is indigenous to this country) to produce the oil on a commercial scale. The press cake will be suitable for use in feeds.

An analysis of the isolated protein shows that the protein contains all the basic amino-acids necessary to produce normal growth, and gives also a strong qualitative test for tryptophane. The principal protein extracted by means of sodium chloride solution is a globulin This was obtained by dialysing the saline extracts and also by precipitation from the extracts by means of ammonium sulphate. The analyses of the globulin reveals a close similarity between it and the coconut globulin The basic amino-acids were determined by the VAN SLYKE method, and the distribution of the nitrogen calculated from the results (HAUSMANN's modified method).

The free amino nitrogen has also been determined, and has been found to agree fairly well with ½ the lysine nitrogen as determined by the VAN SLYKE method.

The authors state that they were unable to fix on a decisive separation point in the globulin construction, and are inclined to believe that only one globulin is present in the cohune nut.

CROPS AND CULTIVATION

121 – **Agricultural Climatology in Swanland, Australia, and its Effects on the Forest Tracts** — GRIFFITH, TAYLOR, in *Quarterly Journal of the Royal Meteorological Society*, Vol. XLVI, No. 196, pp. 352-364. London, Oct 1920.

The Swanland region designates the south-west corner of Australia. The total rainfall always exceeds 10 inches and it differs climatically in this respect from the rest of Australia except perhaps Eyre Peninsula (S. A.). Few regions in the world exhibit such complete rainfall controls as regards natural vegetation as Swanland. The isohyets run parallel to the coastbounding L-shaped strips, and it is possible to divide the country up into districts having a distinct flora.

From Perth round Cape Leenwin to Albany is a strip 40 miles wide receiving more than 30 in., of rain per annum. This was clothed with splendid eucalypt trees of 3 species " Tuart " (*E. gomphocephala*) in the north, " Jarrah " (*E. marginata*) in the centre and " Karri " (*E. diversicolor*) in the south.

The next strip (from 30 to 25 in.,) is marked botanically by a continuous belt of *E. marginata* and the next (25 to 20 in.,) still further east, by a belt of " Wandoo " (*E. redunca*). In strip 4 (20 to 15 in) is the habitat of the York gum (*E. loxophleba*), and also specimens of Mallet gum Salmon gum (*E salmoniphloia*) and Gimlet gum (*E. salubris*) invaluable for mining timbers. These latter grow throughout the drier portions of Swanland *E. diversicolor* and *E. gomphocephala* furnish, on the other hand, excellent timber greatly used for wood-blocks, piles etc.

The appended table shows concisely how man has adapted these belts to his needs.

Rainfall	Timber	Crop	Towns and Mean Monthly Temperature
Over 30 in . . . . . Warmer moiety	*E. gomphocephala.*	Dairies . . . . . Vines. . . . . . Oranges. . . . . Sheep.	Perth . . . . Pinjarra. . . (Jan. 74°, July 55°)
Over 30 in. . . . . . . Cooler moiety	*E. marginata.* . . *E. diversicola* . .	Dairies . . . . . Apples . . . . . Sheep.	Bunbury. . . Denmark . . Albany . . . (Jan. 66°, July 53°)
30–20 in.	*E. marginata* . .	Vines. . . . . . Farms	Gingin. (lately opened up in the South — data insufficient).
20–15 in.	*E. redunca* . . . *E. loxophleba* . .	Great Wheat Belt	Moora. . . . Northam. . . (Jan. 72°, July 50°) York . . . . (Jan. 77°, July 50°) Narrogin. . .
15–12 in.	*E. loxophleba* . .	Dry Wheat Belt. Sheep	Kellerbewin: (Jan. 77°, July 50°)
12–8 in.	Mallet gum. . . Gimlet gum . . Salmon gum . .	Few Sheep and Cattle	Carnarvon: (80°, 61°) Valgoo . . . . Southern Cross (77°, 51°) Kalgoorlie . .

Wheat is by far the most important crop (78 %) and is progressing very rapidly in Swanland, for it has quadrupled its production from 1911 to 1916. Certain varieties are grown in localities with an annual average rainfall as low as 12 in.; these localities occasionally have less than 10 in., in one year and yet may grow wheat fairly successfully with efficient fallowing. There is little grown west of the 30 inch isohyet.

The best areas seem to be those receiving from 15 to 20 in. in the cooler months (April to October).

As regards the less important products, apples grow splendidly in the Karri region, while orchards are general in the Yarrah belt. The vine country lies between the wheat belt and the orchard belt.

122 - **Agricultural Climatology in Tasmania.** — GRIFFITH TAYLOR, in *Quarterly Journal of the Royal Meteorological Society*, Vol XLVI, No 196, pp 354-355 London, Oct. 1920.

Tasmania lies 150 miles to the south of Victoria, between latitudes 40° and 44° S, and its climatic controls differ considerably from those of the mainland. It lies almost permanently under the influence of Antarctic low pressure systems, so that it is swept continuously by the Westerly winds blowing along their northern limbs. Hence the high western region of the island is very wet. A strip about 40 miles long, including Mt. Lyell receives over 100 inches a year which renders agricultural projects impossible. The population is confined almost to the north and east, the chief economic centres being Launceston (January 64°, July 44°) and Hobart (January 62°, July 45°). The tract from Wynyard to Launceston is one of the most fertile and populous districts in Tasmania

In spite of the small size of the island (less than 1 % of the Commonwealth), in such crops as oats and potatoes it is close to Victoria, while a much larger proportion of the population is engaged in orchards and hops than in any of the other States.

Oats is the chief crop, (reaching 2 million bushels in 1916), and the chief centres of production are along the north coast, which received from 40 to 50 inches of rain yearly. This is also grown in the eastern portion of the State, especially near Oatlands (20 to 30 inches).

Wheat is apparently diminishing. Longford is perhaps the chief centre (20 to 30 inches).

The fruits grown in Tasmania include all those of temperate climates but the two out-standing crops are apples and raspberries. The chief centre for both is around Hobart. Potatoes constitute a very important crop on the wet north coast, especially the western half from Wynyard to Sheffield.

Timber is of considerable importance: eucalypts are prevalent in the east (comparatively dry); and in the west (wherever the rain exceeds 50 inches), the eucalypt is largely replaced by the evergreen beech (*Fagus Cunninghami*).

123 - **Mathematical Enquiry into the Effect of Weather on Maize Yield in the United States.** — WALLACE, H A, in *Monthly Weather Review*, Vol 48, No 8, pp 439-446. Washington, August, 1920.

Mathematical studies undertaken with a view to the determination by means of the correlation coefficient method the relationship between various weather factors, (rainfall and temperature in the months of May, June, July and August) and the maize yield.

The method of calculation is by means of correlation coefficients, multiple coefficients of correlation, and lines of regression.

TEMPERATURES AND RAINFALL OF SUMMER MONTHS — The average temperatures for the 29-year period for the 8 maize-belt States are as follows :—

TABLE I. — *Average temperature* 1891-1919.

States	May	June	July	August
	°F	°F	°F	°F
Iowa	59.8	69.2	74.0	72.0
Illinois	62.5	71.6	75.8	74.2
Indiana.	62.4	71.3	75.3	73.6
Kansas	63.7	73.4	78.1	77.5
Minnesota.	54.8	64.7	69.5	67.1
Missouri.	64.9	73.4	77.3	76.3
Nebraska	58.9	68.9	74.3	72.8
Ohio	60.6	69.3	73.7	71.8

TABLE II. — *Average precipitation* 1891-1919.

States	May	June	July	August
	Inches	*Inches*	*Inches*	*Inches*
Iowa	4.66	4.40	3.85	3.40
Illinois	4.22	3.84	3.49	3.32
Indiana.	4.10	3.87	3.48	3.29
Kansas	4.67	4.63	3.73	3.32
Minnesota	3.51	4.17	3.63	3.40
Missouri.	4.99	4.78	4.08	4.08
Nebraska	3.48	3.81	3.24	2.83
Ohio	3.73	3.79	3.94	3.27

In Ohio, the July rainfall is unquestionably the dominating weather factor. The temperature in May, however, is also important, the correlation coefficient being + 0.325, which is relatively high. In some states west of Ohio, the temperature during July assumes an even ~~more~~ dominant position than the rainfall. In Illinois there is a correlation between temperature and yield of —0.657, whereas between July rainfall and yield the coefficient is + 0.651 ; the yield is therefore much higher when it is wet and cool in July.

TABLE III. — *Correlation coefficients between maize, yield and weather.*

States	Yield and temperature				Yield and rainfall			
	May	June	July	August	May	June	July	August
Indiana	+ 0.200	— 0.115	— 0.474	+ 0.040	+ 0.072	+ 0.083	+ 0.591	+ 0.423
Illinois	+ 0.222	— 0.322	— 0.637	— 0.144	+ 0.096	+ 0.110	+ 0.651	+ 0.330
Iowa	+ 0.153	— 0.100	— 0.294	— 0.020	— 0.056	+ 0.117	+ 0.122	+ 0.273
Kansas	— 0.060	— 0.477	— 0.748	— 0.555	+ 0.463	+ 0.410	+ 0.770	+ 0.540
Minnesota	+ 0.224	+ 0.380	— 0.077	+ 0.400	+ 0.041	0.000	+ 0.131	+ 0.422
Missouri	— 0.027	— 0.565	— 0.654	— 0.541	+ 0.263	+ 0.337	+ 0.534	+ 0.495
Nebraska	— 0.110	— 0.217	— 0.594	— 0.424	+ 0.432	+ 0.276	+ 0.587	+ 0.382
Ohio	+ 0.325	— 0.098	— 0.172	— 0.086	— 0.308	+ 0.132	+ 0.653	+ 0.350
Floyd County (Iowa)	+ 0.320	+ 0.220	— 0.096	+ 0.170	+ 0.101	+ 0.083	+ 0.085	+ 0.188
Polk County (Iowa)	+ 0.085	— 0.382	— 0.510	— 0.240	—	—	+ 0.180	+ 0.492

In Missouri, the correlation is — 0.651 with temperature and only + 534 with rainfall: July temperature obviously has more effect than rainfall

In Iowa and Minnesota, the correlation coefficient between yield and July rainfall means practically nothing.

In Iowa the coefficients are as a general rule, very low; the strongest is the negative relationship between July temperature and yield(— 0.294).

For the other States, the observations are as follows: in Indiana, the most important weather factor is the July temperature with a correlation coefficient of — 0.474, July rainfall + 0.591 and August rainfall + 0.423. In the case of Illinois, the July temperature and rainfall and May temperature are involved.

MULTIPLE CORRELATION COEFFICIENTS. — The author has calculated the multiple coefficient of correlation between the yield on the one hand and the 3 selected weather factors. This formula applied in the special case under discussion can be stated thus: —

States	Weather combination	Correlation coefficient
Missouri	June temperature; July temperature; August temperature	0.79
Iowa	May temperature; July temperature; August rains	0.464
Iowa, Polk County	June temperature; July temperature; August rains	0.62
Iowa, Floyd County	May temperature; June temperature; August rains	0.405
Nebraska	May rains; July temperature; July rains	0.67
Indiana	July temperature; July rains; August rains	0.66
Minnesota	June temperature; August temperature; August rains	0.56
Ohio	May temperature; July temperature; July rains	0.746
Illinois	May temperature; July temperature; July rains	0.81
Kansas	June rains; July rains; August rains	0.862

Taking into account all the weather factors as a whole instead of considering one only, it may be noted from this table that the correlation coefficients are very marked and distinctly high.

LINES OF REGRESSION — There is a positive correlation coefficient, as for example between the yield and the rains, an increase in the latter will correspond to an increase in yield. By means of the formula for working out lines of regression, it is possible to calculate the increase in yield relative to the meteorological value.

The average June temperature for Missouri is 73.4° F., that for July, 77.3° F., and for August 76.3° F. As the present time the normal maize yield is 28.1 bushels per acre.

Between the yield of maize and June temperature, the correlation coefficient is negative. Applying the formula for working out the line of regression the author found that for each extra degree June temperature is above 73.4° F corresponds to a decrease in yield of 0.8 bushels, whereas for each degree below 73.4° F, the maize yield is increased by 0.8 bushels.

In a similar way, in July and August, a rise or fall of 1° F, córresponds to a decrease or increase in yield, equal to 1.1 and 0.4 bushels respectively for each decree.

Taking a specific case; when in Missouri, the June temperature is 72.4° F, the July temperature 75.3° F and the August temperature 75.3° F, we should expect a yield 0.8 bushels above normal, because of the low June temperature, 2.2 bushels above normal because of the low July temperature, and 0 4 bushels above normal because of the August temperature or a total of 3.4 bushels above normal, or a yield of 31.5 bushels per acre.

In Missouri, between the yield of grain and the temperature in June, July, and August, there is a rather high multiple coefficient of correlation of 0.79.

PREDICTING FORMULAE FOR MAIZE YIELDS. — By means of working out the lines of regression, the predicting formulae can be taken as fairly accurate. The following have been worked ont by the author:

Iowa: $x_0 = 0.77\, x_1 - 1.4\, x_2 + 1\ 26\, x_3.$

where x_0 = % deviation of yield.
x_1 = deviation of May temperature from average in °F.
x_3 = deviation of July temperature from average in °F.
x_8 = deviation of August rain from average, in inches.

Illinois:

$x_0 = 0.98\, x_1 + 4.33\, x_2 + 4.38\, x_3.$
where x_0 = % deviation in yield.
x_1 = deviation of May temperature from average in °F.
x_2 = deviation of July temperature from average in °F.
x_3 = deviation of July rain from average in inches.

Ohio:

$x_0 = 0.8\ x_1 + 1.9\ x_2 + 0.9\ x_3$.
where x_0 = % deviation of yield.
x_1 = deviation of May temperature from average in °F.
x_2 = deviation of July rain from average in inches.
x_3 = deviation of August rain from average in inches.

Kansas:

$x_0 = 3.7\ x_1 + 10.7\ x_2 + 7.5\ x_3$.
where x_0 = % deviation of yield.
x_1 = deviation of June rain from average in inches.
x_2 = deviation of July rain from average in inches.
x_3 = deviation of August rain from average in inches.

Minnesota:

$x_0 = 1.6\ x_1 + 0.8\ x_2 + 4.2\ x_3$.
where x_0 = % deviation of yield.
x_1 = deviation of June temperature from average in degrees.
x_2 = deviation of August temperature from average in degrees.
x_3 = deviation of August rain from average in inches.

Floyd County, Iowa:

$x_0 = 1.65\ x_1 + 1.14\ x_2 + 1.83\ x_3$.
where x_0 = % deviation in yield.
x_1 = deviation of May temperature from average in degrees.
x_2 = deviation of June temperature from average in degrees.
x_3 = deviation of August rain from average in inches.

Polk County, Iowa:

$x_0 = 0.8\ x_1 - 2.4\ x_2 + 3.1\ x_3$
where x_0 = % deviation
x_1 = deviation of June temperature from average in °F.
x_2 = deviation of July temperature from average in °F.
x_3 = deviation of August rain from average in inches.

Indiana:

$x_0 = 1.6\ x_1 + 3.6\ x_2 + 1.5\ x_3$.
where x_0 = % deviation of yield.
x_1 = deviation of July temperature from average in degrees.
x_2 = deviation of July rain from average in inches.
x_3 = deviation of August rain from average in inches.

Nebraska:

$x_0 = 3.48\ x_1 - 2.96\ x_2 + 3.08\ x_3$.
where x_0 = % deviation of yield.
x_1 = deviation of May rain from average in inches.
x_2 = deviation of July temperature from average in °F.
x_3 = deviation of July temperature from average in inches.

In applying these formulae, it is possible to predict more or less exactly the yield under consideration.

IOWA WEATHER AND YIELD OF MAIZE. — The multiple coefficient of correlation between yield and May temperature and August rain is disappointingly low, and the method of correlation coefficients is not well adapted in this case, considering that Iowa is probably the most important of all the maize States.

A superficial examination of the evidence leads to the conclusion that the low correlation coefficient in Iowa is due to the fact that there are some seasons and some sections in which the yield is low because of the particularly cool weather during the greater part of the summer, whereas in other years the yield is low because of the hot weather.

It is generally recognised that in exceedingly hot seasons, the yield is often excellent in northern Iowa, whereas in Southern Iowa the yield will be very seriously damaged, and vice versa in cool seasons. The existence of these contrasts can only lessen the value of the correlation coefficient. It is considered advisable therefore to confine attention to less extended areas, in order to mitigate the above mentioned contrasts.

Taking Polk County (S. Iowa) and Floyd County (N. Iowa), it will be noticed that the relationship between temperature and yield was as follows: May temperature + 0.085; June temperature — 0.382; July temperature — 0.510; August temperature — 0.240; July rainfall + 0.180; August rainfall 0.492. The three most important factors are apparently June and July temperatures and August rainfall. The multiple coefficient of correlation is 0.62; this is somewhat higher than that secured for the entire State. On the other hand, as it has already been shown, the higher the multiple coefficient, the more exact are the lines of regression and the prediction relative to the yield.

A series of 8 tables includes all the data relative to the increase or decrease of yield in relation to the rise and fall of meteorological values: the use of these tables permits the formation of predictions concerning the yield to be very nearly accurate.

In Floyd County which is situated only 150 miles north of Polk the following are the correlation coefficients. May temperature + 0.32; June temperature + 0.22; July temperature — 0.10; August temperature + 0.17; July rainfall + 0.083. Warm Mays are apparently of distinct importance in Floyd County, and whilst the warm Junes and Augusts tend to produce on the average a positive effect, it is precisely the contrary in the case of Polk County.

The lines of regression calculated for Floyd County are utilisable from a practical standpoint when the season maintains a distinct type throughout such as 1915, which was cool and wet, and consequently injurious to the crop. The decrease in yield corresponds very nearly to that predicted according to the correlation coefficient.

On the contrary, in 1912, May and July were warm, whereas June and August were cool. The rainfall was practically normal throughout the season. The yield, which according to the calculated coefficients should have been only slightly higher than the normal yield, showed a superiority of 42 %.

CONCLUSIONS. — The problem of predicting the maize yield from the weather is relatively simple in the southern half of the "corn belt," notably in Kansas, Missouri, and Southern Illinois, where drought and heat in June, July, August are the chief influences. The problem is to measure the degree of drought and heat with accuracy. In the northern part of the "corn belt" and especially in Northern Iowa, the application of the proposed method has not given practical results. The relationship between the yield and the July temperature, for example, is not strictly linear. For instance, when the July temperature is 68° F, the yield may possible tend to increase 6 % above normal; when 69°, to 13 %; when 70° to 14 %; when 71° to 15 %; when 72° to 13° (already a less marked degree of increase in yield with a temperature above 71°); when 73°, 12 %; when 74°, 10 %; when 75°,8 %; when 76°, 6 %; when 77°, 4 %; when 78°, 2 %, and finally, temperatures above 78° produce a diminution below the normal mean; when 79°, this has already amounted to 2 %.

In any case, the correlation formulae may be applied in a general way for trial purposes and taken as a whole, to weather conditions relative to different crops.

124 - **Damage to Crops by Weather in the United States.** — WARREN SMITH J, in *Monthly Weather Review*, Vol. 47, No. 8, p. 446. Washington, Aug. 1920.

The following table gives the average damage per cent. to crops in the United States due to different factors or unfavourable weather conditions:

	Deficient Moisture	Excessive Moisture	Floods	Frost or Cold	Hail	Hot winds	Storms	Total weather	Plant diseases	Insect pests	Animal pests	Defective seed	
Wheat	12.4	2.0	0.3	4.5	1.1	2.0	0.3	22.9	2.7	2.1	0.2	0.2	28.8
Maize	16.3	4.0	0.9	2.0	0.4	2.2	0.5	27.7		2.7	0.2	0.7	32.1
Oats	13.4	2.7	0.3	0.8	0.8	1.9	0.4	20.8	1.7	0.9	0.1	0.2	24.5
Barley	17.1	1.8	0.1	0.8	1.3	3.2	0.4	24.9	1.7	0.7	0.3	0.1	28.7
Flax	21.1	1.3	0.1	4.0	1.7	3.0	0.2	31.8	2.2	0.9	0.1	0.3	36.4
Rice	6.7	3.1	1.3	0.3	(1)	0.4	1.8	14.1	1.2	0.8	0.3	0.1	19.0
Potatoes	14.4	3.1	0.2	1.6	0.1	0.7	0.1	20.7	4.4	3.2	0.1	0.3	30.0
Tobacco.	8.7	3.7	0.6	1.1	0.5	0.2	0.3	15.8	0.4	2.6	—	0.1	30.5
Hay	13.4	1.7	0,3	1.7	0.1	0.6	0.2	18.4	0.1	0.5	0.1	0.1	20.4
Apples	5.4	1.6	0.2	14.6	0.8	0.5	0.9	24.9	3.7	3.6	0.1		39.6
Berries	9.3	1.7	0,2	7.3	0.5	0.6	0.2	20.3	1.1	0.6	0.1		21.9
Cotton	12.3	4.3	1.0	1.4	0.5	1.6	0.7	22.3	2.0	9.7	(1)	0.2	35.3

(1) Less than 0.05 per cent.

125 - **Frost and the Prevention of Damage by It.** — *Farmer's Bulletin* No. 1096. United States Department of Agriculture, pp. 3-48 Figs 24. Washington D. C. April 1920.

A description of the actual effect of frost on soil and vegetation, followed by a discussion of various methods and devices now being used for protection purposes, and the temperatures injurious to plants, blossoms and fruits, with special reference to citrus fruits.

126 - **The Choice and Use of Instruments for Measuring Radiation in Agricultural Climatological Researches.** — VALLOT, J., in th *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 12, pp. 720-722. Paris, March, 1920.

The amount of solar heat has hitherto only been studied from the purely physical standpoint. It is true that pyrheliometers or actinometers have been made for the purpose of measuring solar radiation, by separating it from sky radiation, but the readings given by these instruments are of a very relative nature, and cannot be reduced to any absolute physical unit.

If it be remembered that the heat supplied by the sky can amount to $^1/_3$ of the direct solar radiation, it is easy to understand how inadequate are these actinometers in researches on agricultural climatology. Of all the existing instruments, BELLANI's totalising actinometer with a blue thermometric basin is the one that has given the best results. It consists of a receptacle of coloured glass containing alcohol, and protected by an exhausted glass sleeve. Acted on by the radiation, the alcohol distills off and condenses in a graduated tube attached to the basin.

This actinometer is checked by comparison with an ARAGO actinometer, both instruments being exposed to the total radiation.

By means of a continuous series of observations, an adjustment curve for the different parts of the condensation tube has been made. When the instrument has been tested and marked, it needs no further checking. By means of careful study, the following facts have been determined:—

(1) The amount of alcohol distilled, decreases as the basin is emptied. The control curve must thus be determined by careful reference to an ARAGO actinometer, or some other previously tested totaliser.

(2) Every instrument has its special curve which is related to the tint of the basin, and the amount of alcohol; when, however, this curve is well defined, it changes no further.

(3) The temperature of the air has no effect upon the distillation of the instrument.

Two readings a day, one taken at mid-day, and the other in the evening, are all that is needed to obtain the total number of calories supplied during the day by the sun and the sky. Therefore, this instrument is perfectly adapted to agricultural meteorological research.

127 – **Experiments on Soil Evaporation in Germany.**— KRUGER, E., in the *Internationale Mitteilungen fur Bodenkunde*, Vol X, Parts 1 and 2, pp. 1-13. Berlin, 1920.

The influence that the nature of the soil exercises on the evaporation of rain water or that which already exists in it, constitutes an extremely important agricultural question. This question has already been the subject of various researches by WOLLNY, FLEISCHER and SEYFERT, and although these workers, have arrived at very different numerical results, they all came to the same conclusion, viz., that a layer of sand spread over peaty soil decreases evaporation.

The author carried out some experiments with peat and mineral soils, with which he filled 6 cylinders made of white metal, with wire-gauze bottoms covered with filter paper, which was saturated with water by capillary attraction by immersion in water, or by artificial rain; afterwards they were exposed to evaporation in a closed place, or one where the air had free access but always protected from the rain.

A series of experiments were made from April 24, 1918 to September,

1919. The loss of water by evaporation determined by means of weighing periodically with due care, are summarised in various tables, from which the author concludes as follows: —

(1) Without rain, the evaporation of peat soil covered with sand (5 cm. deep) is less than that of uncovered peat soil, and the difference is not so great as that recorded by FLEISCHER and SEYFERT (1).

(2) Variations in the depth of the bed of sand have but little influence on the amount of evaporation.

(3) In the presence of rain, these results are inverted, in the sense that, if an area of peat soils is covered with sand, evaporation is greater than if the peat soil is uncovered, with a difference which increases with the frequency, and decreases with the number of times rain falls.

The author also describes other experiments made between March 20, 1917, to January 1918, with a view to contributing to the controversy which exists between soil chemists, some maintaining that the evaporation of clay soils is greater, and others that it is less, than that of sandy soils.

The author has obtained results in the way described above which he has summarised in various tables, from which it appears that:

(4) Without rain, the quantity of water evaporated from clay, with regard to the total humidity of the saturated soil, is less than that of sand.

(5) In the presence of rain, very damp clay soil evaporates much more water, in the absolute sense as well as relatively to the preexisting humidity, that is to say contrary to the results obtained with pure sand (2).

128 – **Cause of Lime-Induced Chlorosis and Availability of Iron in the Soil.** — GILE, P. L. and CARRERO, J O (Porto Rico Agricultural Experimental Station), in the *Journal of Agricultural Research*, Vol. XX, No. 1, pp. 33-61, Tables 13, Pl. 2. Bibliogr of 45 works. Washington, D. C., Oct. 1, 1920

The more important facts already established concerning the causes of lime-induced chlorosis are given together with a full report of certain experiments on this subject, hitherto unpublished.

As a result of soil surveys, several species of cultivated plants showed that a particular type of chlorosis affecting these plants occurred only on calcareous soils. All calcareous soils, however, did not induce chlorosis in these plants, for example, green cane was found growing on a soil containing 76.70 % calcium carbonate. This supports the idea that it is not the carbonate of lime itself that induces chlorosis, but some condition usually associated with the presence of the carbonate of lime.

The weight of the evidence from ash analyses of chlorotic plants seemed to point to a deficiency of iron in the ash as being one cause of chlorosis with possibly an excess of lime as a contributory cause. Previous work with rice showed that the percentage of iron in the ash diminished very markedly as the plants became more mature (1).

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(1) The action of a covering of sand on the evaporation on the covered soil is also a function of the thermal relation between the covering and the soil. See *R.*, 1916, No. 8 (*Ed.*)

(2) See *R*, 1915, No. 248, and *R.* 1917, Nos. 119 and 704. (*Ed.*)

Treatment of chlorotic plants with iron showed that the lack of iron in the plant was at least one of the causes. Whether the lack of iron is due to a low availability of iron in the soil or to reactions in the plant rendering ineffective the iron absorbed; whether an increased absorption of lime is a contributory cause or whether the reaction of the soil has any effect on the appearance of chlorosis, apart from affecting the iron supply, are all points not proved by these results.

Experiments with various plants showed there is no evidence of a general " lime effect " in inducing chlorosis, the different lime compounds having a varying effect on the plants. Rice, which is sensitive to lime did not appear to be sensitive to the alkalinity except as this alkalinity influences the availability of iron. It was found that the ratio of root to top growth was much increased in calcareous soils and solutions (2). Other work with rice in water cultures seemed to show definitely that the alkalinity of carbonate of lime is not directly injurious to this calcifugous plant, nor is the alkalinity in itself the cause of chlorosis.

The authors' experimental results where a la ge amount of sodium bicarbonate was required to depress growth, seemed to indicate that a slight alkalinity of carbonate of lime could not be directly injurious to rice and this supports the afore-mentioned conclusions.

An attempt was made to demonstrate directly that the only action of carbonate of lime in inducing chlorosis lies in depressing the availability of iron. The principle which tended to make the results less striking than had been anticipated is the following: Plants apparently are unable to attain a maximum absorption of any one element with only a part of their roots (3).

The work on the availability of iron compounds was based on the assumption that the chlorosis and the poor growth of rice in the calcareous soils were caused by a lack of available iron. Previous experiments by the authors proved that colloidal iron was unavailable for rice in water culture (4) and RUPRECHT proved that acid soils may contain much more soluble iron and aluminium than neutral or calcareous soils, even to an injurious extent (5). In the case in hand bulky organic compounds such as stable manure, velvet bean plants and tobacco stems, when used in considerable quantity, however, enabled the plant to secure more iron. The availability of iron in calcareous soils appeared to be slightly greater near the optimum water content of the soil than at higher percentage of water. Although rice becomes chlorotic in calcareous soils with ordinary percentage of water, it may be expected to make a practically normal growth in certain cases of the soils are submerged. This is considered to be due to growth of a new kind of root that is better able to assimilate iron.

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(1) See *R.* March 1916, No 276 (*Ed*)
(2 See *R.* July 1917, No. 626. (*Ed.*)
(3) See *R.* Sept. 1918, No. 970 (*Ed.*)
(4) See *R.* May 1915, No. 475. (*Ed*)
(5) See *R.* Dec., 1915, No. 1263. (*Ed*)

129 – **Lime and American Vines** (1) — DE ANGELIS D'OSSAT, G, in the *Atti della R Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIX, Parts 1-2, 2nd Half-year, pp. 58-62. Rome, 1920.

Certain authors maintain that it is the quantity of lime which directly causes chlorosis of the plants, and especially of the American varieties; on the other hand, others hold that it is due to the special physical state of the lime rather than its abundance. Amongst the latter are MM. HOUDAILLE and SÉMICHON (1892-1900) who have invented some ingenious instruments for the determination of the specific speed of attack or the chlorotic power of lime contained in agricultural soils.

In Italy, when reconstituting the vines that were destroyed by phylloxera, the degrees of resistance to lime (RAVAZ-GUILLON-BONNET) of the American varieties were followed, and many failures ensued.

TH. SCHLOESING (1872) has shown that the quantity of lime cannot be the only direct cause of chlorosis; he formulated a law in which the tension x of the carbon dioxide of the soil atmosphere is correlated with the weight y of calcium carbonate in solution, expressed by the formula:—

$$x^{0.3787} = 9218\, y.$$

In a previous note (1914), the author proposed to show that the specific speed of attack of the lime, although it existed theoretically, could not yet be determined with sufficient precision. He was able to deduce from his experiments that:— 1) The quantity of calcium carbonate dissolved in a given time is different in limestones of approximately equal, physical state; 2) the quantity of carbonate dissolved in a given time varies also in the same rock; 3) in each lime stone, with the same area and in equal time, repeated experiments have shown that there is an irregular decrease in the amount of substance dissolved.

It is therefore impossible, *a fortiori*, to succeed in investigating the specific speed of attack of the lime which forms part of agricultural soils; the differentiation of this lime under active and passive forms is purely empirical.

In a later note (1920), the author has been able to formulate, using these facts as a basis, a direct contradiction to the scale of resistance. He now makes the following observations on this questions:—

The water circulating in agricultural soils, liberates the bases by its hydrolysing power, and these bases, uniting with the carbonic acid, form the carbonates. Thus the carbonic acid destroys the momentary equilibrium due to the hydrolysis and enables other mineral substances to pass into solution. But the action of the calcium is antagonistic to that of the magnesium, whence the necessity of a ratio between these two elements, which varies for each plant; the most favourable ratio between these two elements for the American varieties is not yet known. Moreover there is an indirect action of this ratio which aids the absorbtion of other nutritive elements. The normal growth of the plant requires physiologically balanced doses of the assimilable elements. Recent experiments have shown that the two elements calcium and magnesium are united to two others, phosphorus and potassium, by well defined influences and relations, and that their action depends on the presence of other mineral elements. The destructive action of an element, however, does not depend on its absolute quantity, but on the degree to which it is absorbed; from this point of view, research, pure and simple, on the quantity of lime in useless.

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(1) See *R.*, July-Aug., 1920, No 765 (*Ed.*)

The solubility or insolubility of iron and of manganese in agricultural soils is thus united, with the chloroses which it causes, to conditions which do not require a determined quantity of lime, but only its presence or absence in an alkaline medium. But the root acids (oxy-acids) often intervene opportunely; as they form special complex compounds they make the solubility of the iron and manganese equally possible and thus remove an immediate cause of chlorosis. It must be concluded from this that it is the presence and not the quantity of lime which is necessary and that chlorosis is eventually subordinated to the free alkalinity of the soils and to the lack of the emission of certain root acids.

The solution of lime is subordinated, according to the law of SCHLOESING, to the formation and circulation of carbon dioxide in the agricultural soil. Now, the production produced and circulation of this gas depends on the physical properties of the soil; and these depend, in turn, directly on the form in which the colloids occur. It is easy to understand that the action of the carbon dioxide will be favoured in open, porous and permeable soils, whose structure is glomerulate (reversible hydrosols and hydrogels or tending to reverse). Although the calcium plays a certain part in the transformation of the gels into elements which are more or less reversible, it seems evident, however, that the "pedetic" and "antipedetic" phenoma do not depend on the quantity of lime but on the form in which the colloids occur in the soil, that is to say, the presence of the OH-ion in alkaline soils or the *H*-ion in acid soils, and, to a lesser degree, on the monovalence or polyvalence of the radical ions

It cannot be claimed that it is possible to ascertain, by a single volumetric analysis of the quantity of lime contained in an agricultural soil, all the details of so exceedingly complicated a question.

130 - **The Ehrenberg Law on the Relation Between Potash and Lime.** — MAYER, A., in the *Deutsche landwirtschaftliche Presse*, Year 47, No. 14, p 108. Berlin, 1920.

The law in question is formulated by PAUL EHRENBERG as follows: Every time that the amount of lime available is increased for a plant which has but little potash at its disposal, the absorption of potash decreases, with consequences that may be very harmful. But if the supply of potash is increased unilaterally, the plant will be newly safeguarded against the excess of lime and will attain perfect development.

According to the author, EHRENBERG's law can be amply substantiated, and it clears up facts which until now have remained unexplained. All the harmful effects of lime are thus connected with a lack of absorbtion of potash; the apparent calciphobia of lupins and numerous other herbaceous and arborescent plants can be clearly explained by this law.

Nevertheless, the author considers that it not a case of a law of a special kind, but of the consequence of the general law of absorbtion, which is based, not on mysterious selective powers, but on determined physical laws regarding osmosis, as well as on determined physiological laws regarding the fixation of substances which are absorbed in a form which is no longer diffusible. In fact, if several salts are awaiting entrance into the roots, each stands less chance of being absorbed in considerable quantities. The excess of another base in addition to lime, will thus influence the reduction of the absorbtion of potash.

It is necessary to consider, besides, the two independant properties which most crops possess, viz., those of a greater or less need of lime and potash and of a greater or less aptitude for appropriating them at the expense of substances of varying assimilability. As regards this, the author suggests that special tables should be drawn up to show these two properties in different plants, which would be of practical use for fertilisers and crop rotations

The author states that the direction followed by agricultural chemists who wish to confine metabolism to the narrow limits of physical and mathematical knowledge is entirely erroneous.

131 – **Effect of Alfalfa on the Subsequent Yields of Irrigated Field Crops.**— SCOFIELD, C S., in *United States Department of Agriculture, Bulletin*, No 881, pp 1-13, Tables 5 Washington D C, August 10, 1920.

Report of experiments carried out at 3 different Stations in the northern Great Plains, to ascertain the extent of the beneficial effect of growing alfalfa in rotation with Irish potatoes, oats and sugar beets grown on irrigated land. The trial tests covered a period of 6 years. Comparison is also made between these crop yields when grown in the same sequence but without alfalfa. A further comparison is made in the case of potatoes and sugar beets, as to the relative effect of alfalfa in rotation and the application of farmyard manure at the rate of 12 tons per acre, once during the period of rotation.

Results showed that when the soil is a light sandy loam, the effect of alfalfa has been to increase the yields per acre as follows:— potatoes about 100 bushels, oats about 6 bushels, sugar beets 3 4 tons:

On heavy clay loam rich in organic matter, no beneficial effect was apparent, and the effect on oats and sugar beets was too slight to be regarded as significant.

On a very productive clay loam, the increase in yields per acre showed: — for potatoes; about 50 bushels, without, however, increasing the proportion of marketable potatoes, which was relatively high on all the plots, oats about 11 bushels, and sugar beets about 1.5 tons.

While these results do not show a strikingly beneficial effect from the use of alfalfa in the rotation in the case of oat yields, it should be noted that these crops were grown on soil that was virgin at the beginning of the experiment and of relatively high productivity as shown by the mean yields of all the plants included in the experiment. In the case of sugar beets the alfalfa appeared nearly as beneficial as the periodical applications of manure, even although the position of the beet crop in the alfalfa rotation was not so favourable as in the manured rotation. While both manure and alfalfa have increased the yield, the size of the beet, and the vigour of growth as expressed in the larger proportion of tops, there has not been a corresponding increase in the percentage of sugar in the beets.

132 — **Fertilising Value of Water Used to Remove the Bitter Taste of Lupins.** — See. No 119 of this *Review*

133 - **Studies on Alpine Plants.** — BERTIN, L. (Fellow of Paris University), in *La Nature*, No 2435, pp. 353-356, figs 4. Paris, Dec 4, 1920

Alpine plants are characterisd by :— The limited development of the epigeal parts in contrast to the enormous development of the hypogeal parts; great hairiness; large, brightly coloured flowers, that are very nectariferous; rich aroma; thick cuticle which protects the leaves; distribution of the chloroplasts throughout the whole mass of leaves instead of their being localised towards the upper surface as is the case with the plain species; epidermis of the stem thickened and suberified, or furnished with some other protective tissue, etc. These plants therefore have been considered quite different from their relations of the plains.

But, as the result of experiments extending over 35 years and still in progress, M. G. BONNIER, Professor of Botany at the Sorbonne, has succeeded in transforming meadow species into alpine species. He has made use of three methods, viz.: (1) Comparative cultivation in plain and mountain; (2) cultivation in an artificial " Alpine environment "; (3) cultivation in seed-plots.

(1) The same plant gathered from the plains was divided into several cuttings, of which some were cultivated and multiplied in the plains and others on the mountains. Of these last, a large part perished from the effect of cold without snow; others became transformed very quickly, but died some years later. On the other hand, about sixty species adapted themselves to the new environment and became transformed into alpine species. There were thus obtained from the same initial plant always reproduced agamously: — *Trifolium pratense* of the plains and *T. nivale* of the mountains; and respectively *Juniperus communis* and *J. nana*; the common cistus and the helianthemum cistus of the Alps; *Veronica officinalis* and *V. Tournefortii*, etc.

(2) The alpine climate is specially characterised by very warm days (up to 50° C.), by cold nights, by intense light, and by a short period of growth.

By covering with pounded ice, from September to June, the soil of the pots in which the experiments were made; by putting the pots every night, from July to August, into a refrigerator and exposing them during the day to the warmth of the solar rays further increased by reflecting mirrors, M. BONNIER has reproduced artificially, at the Biological Station of Fontainebleau, the chief conditions of the alpine climate except that of altitude. The meadow plants cultivated under such conditions, agamous reproduction always being used, were not long in changing their form; the epigeal part diminished greatly, the leaves became a darker green, the flowers more brightly coloured, etc. In short they were transformed, so to speak, into "artificial Alpine plants".

(3) In July, 1919, M. BONNIER sowed at the Pic du Midi (altitude over 6000 ft.), seeds of various species gathered from the plains; the plants obtained resembled not the meadow species, but the corresponding alpine species. Thus from seeds of the *Trifolium pratense* he obtained plants equal to *T. alpinum* plants of the same age. The same thing occurs with wild poppy, cornflower, mallow, lucerne, columbine, and burdock.

134 - **Researches upon the "Flowerless" Apple-tree.** — LONGO, B, in the *Atti della R. Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIX, Part 9, pp. 290-291. Rome, Nov. 7, 1920.

From a superficial examination it would appear that the so-called "flowerless apple-tree" bears fruit without having flowered. But, in reality, the plant produces small floral buds, of which some open, some only partly open and other do not open at all. However, even those which open do not produce visible flowers, for their petals are very small (smaller than the sepals) and sepaloid. The flowers are pistilliferous but show no trace of stamens; in the place which the stamens occupy in the common apple-tree are found several free pistils. Consequently each flower is composed, not only of the five adherent carpellary leaves, which form the usual lower pentalocular ovary, but also by several other carpellary leaves, situated higher up and each forming a pistil.

Thus the carpellaries, and consequently the cells, are arranged on two levels; on the lower level are the 5 adherent leaves, as in the common apple-tree. On the upper level are the others, free, which are not found in other apple-trees.

In the above-mentioned flowers there is no pollinisation, because they are not visited by honey-seeking insects. Despite this, both the flowers which open and those which remain shut bear fruit which, however, does not contain seeds. We are confronted then with a true parthenocarpy in the strict sense of the word, since the plant bears fruit without seeds and without its having been fertilised or pollenised.

Microscopic examination shows that each of the cells on the lower level contains 2 more or less normal ovules. Those of the upper level either contain none at all, as is most frequently the case, — or contain only one or very rarely two; but generally these ovules are abortive and in very few cases attain completely normal development.

The author has tried artificial pollinisation, making use of the pollen of other sorts of apple-trees, and has obtained fruit with seeds which he proposes to sow in order to continue his studies.

135 - **Composition of Brazilian Maniocs.** — See No 155 of this *Review.*

136 - **Tannic Substances in the Mulberry.**— GHIRLANDA, G, in the *Atti della R Accademia dei Lincei, Serie quinta, Rendiconti Classe di Scienze fisiche, matematiche e naturali,* Vol XXIX, Part 4, pp 146-148 Rome, Feb 15, 1920

Researches undertaken at the " R. Stazione bacologica," at Padua, show that, except the wood of the branches, all the parts of the mulberry contain appreciable amounts of tannic substances. The leaves contain the most (0.509 % of the dry matter collected in the morning, 0.417 % in the evening) ; followed by the root bark (0.36 %) branch bark (0.209 %) and root wood (0.119 %). The quantity of tannin in leaves collected in the morning is greater than that in leaves collected in the evening, contrary to what has been observed for the organic substances. This may be explained by the hypothesis put forward by several authors, viz., that the tannic substances are not produced by assimilation, but may well be secondary products of the synthesis of the albuminoids.

137 - **Influence of Low Temperatures on the Germination of Wheat as soon as Harvested and on Fresh Seed in General.** — MUNERATI, O, in the *Atti della R. Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali,* Vol. XXIX, 2nd Half-year, Parts 7-8, pp 273-275 Rome, 1920.

The author has studied the mechanism of the quiescence (resting) of the seeds of some of the worst weeds of the Lower Po Valley, in the hope of being able to apply the results of his studies. His attention was drawn to the question by a communication from G. T. HARRINGTON published in *Science* (New Series, Vol. L, No. 1301, p. 428) in which this author affirms, contrary to the general opinion, that 100 % of ordinary cereals can germinate as soon as harvested, provided that they are maintained at a temperature of 12-16° C. The author has observed the same phenomenon with wheat gathered in different localities, during harvest and immediately after threshing. The tests were made simultaneously in an incubator at 33-35° C., at a laboratory temperature of 25-28° C., and in a refrigerator. The average results were as follows :—

	Percentage of grain germinated	
	after 3 days	On the 12th day
At 32-35° C.	3	14
» 25-27° C.	14	29
» 12-15° C.	81	96

Wheat seed of the 1919 crop under the same conditions gave, after 12 days, about 55 % in the incubator, 84 % at normal temperature, and 93 % in the refrigerator.

Further experiments also show that a sudden drop in temperature due to storms, results in greater germination than in the case of grain tested on the same day in a common medium, and that these same samples, tested at another period with a normal temperature gave a much smaller rate of germination.

The author also wished to ascertain whether low temperatures could cause quicker germination of the so-called "fresh" seed, belonging to common weeds. The largest seed of *Avena fatua* (which is the first of the seeds of that species to emerge from the quiescent stage), was put to germinate a week after harvest: it gave on the 12th day: —

At a temperature of 25—28°..... 3 % germination
» » » » 12—15°..... 72 % »

A. fatua seeds usually germinate in great numbers in the autumn after they have fallen on the soil. This is not due solely to the great amount of rain which falls when this grain is undergoing those intimate changes that "perfect" them or make them "ready for germination," but also to the low autumn temperatures. These observations, whilst confirming G. T. HARRINGTON'S observations on this subject, show the necessity of modifying the fundamental ideas prevalent as regards the interpretation of the mechanism of quiescence of certain types of seed. HARRINGTON'S and the author's researches do not confirm the supposition that the embryo of these seeds is not "physiologically perfect" at harvest time, or lacking diastases that can make the reserves available.

138 - Respective Roles played by the Bases, Potash, Lime and Magnesium, in Cultivated Plants. — LAGATU, H., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 2, pp. 129-131 + 1 fig. Paris, Jan. 10, 1921.

The recent development of the use of and trade in magnesium as a fertiliser, particularly in the form of calcined dolomite, is worth the attention of agricultural scientists. The works of LOEW and many cultural tests show that the addition of magnesia and lime to the soil may, in certain cases, be more advantageous than lime alone. The author has investigated the question for which plants the analysis of the crop suggests this practice more specially.

Among the mineral nutrients that plants absorb he reckons potash, lime, and magnesia. He admits that each of these bases plays a specific part, in other words that they cannot replace one another, and so he has adopted the common monobasic equivalent $\frac{K_2O}{2}, \frac{CaO}{2}, \frac{MgO}{2}$, that is to say, the quantity of base necessary to neutralise an acid equivalent, such as 46.5 of hydrochloric acid.

On the other hand the requirements of the crop as regards these three bases is known. The percentage of potash, lime, and magnesia contained in different plants can be used to calculate the basic equivalents, and the following problem arises :— Out of 100 basic equivalents attributed to the whole of the potash, lime and magnesia basis, what part does each play in the various crops ?

The author, using the analytical statistics given by MUNTZ and A. CH. GIRARD in their classical work *Les engrais*, has drawn up a table, of which the following is a part :—

	Potash Per cent.	Lime Per cent.	Magnesium Per cent.
Wheat	43.4	28 3	28.3
Maize.	49.1	23.9	27.0
Sugar beet	42.1	24.0	34.8
Lucerne.	21.2	67.4	11.4

The various crops show very different distributions of the 100 basic equivalents. A better method of comparison would be to make a graph of the equivalents, using the result from each crop as a point. The graph could be made on the surface of an equilateral triangle or a rectangular isosceles triangle. This last method is shown in the figure on page 164.

Interesting agricultural and physiological observations are suggested by this graph. In order to use magnesia correctly as a fertiliser the median of the right-angle is used. This corresponds to the ratio :

$$R = \frac{\text{number of magnesia equivalents}}{\text{number of lime equivalents}} = 1$$

This ratio has been the object of important studies by LOEW and his associates. The analytical statistics shown by the graph indicate that amongst the cultivated plants, the sugar beet above all, then mangolds, maize, and potato correspond to a ratio of $R < 1$. In other words, these plants require a greater chemical action from magnesia than from lime.

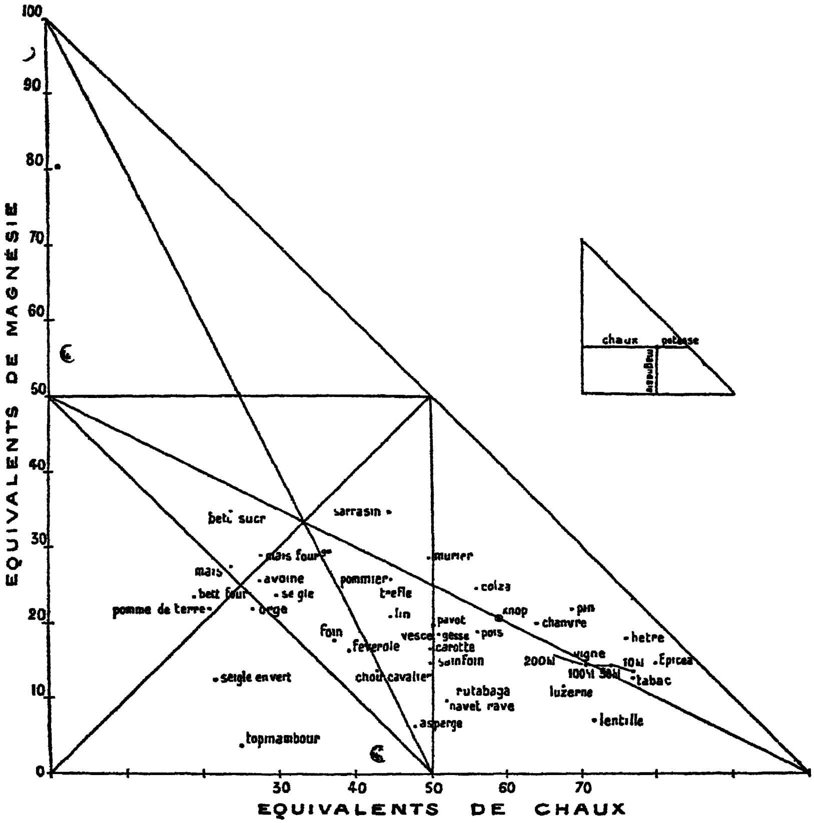
Wheat requires exactly the same amount from each of these 2 bases ; oats, rye, barley, and buck wheat approximately the same. These analytical deductions explain the experimental results recently obtained with calcined dolomite, more particularly with reference to the plants cited above. On the other hand, it does not appear justifiable to expect all cultivated plants to give the same order of results.

The median lines and those parallel to the sides of the triangle delimit the most interesting areas :

(1) The small rectangular-triangles having a common apex with the main triangle : if the representative point is found in it, one of the bases represents an alkalinity greater than that of the sum of the two other bases.

(2) A quadrilateral, being the height of the mid points of the two sides of the main triangle, and a corner coinciding with an apex of the triangle if the representative points is situated in it, one of the bases represents an alkalinity greater that that of each of the bases, considered separately.

[138]



Equivalents de Magnesie = Equivalents of magnesia.
Equivalents de Chaux = Equivalents of lime.
Asperge = Asparagus
Avoine = Oats
Bett. fourr. = Mangold
Bett. sucr. = Sugar beet
Carotte = Carrot
Chanvre = Hemp
Chou cavalier = "Cavalier" Cabbage.
Colza = Rape
Epicea = Spruce
Feverole = Horse bean
Foin = Hay
Hêtre = Beech
Knop = Knop
Lentille = Lentil
Luzerne = Lucern
Maïs = Maize
Maïs fourager = Fodder maize
Mûrier = Mulberry
Lin = Flax
Navet-rave = Turnip
Orge = Barley
Pavot = Poppy
Pin = Pine
Pois = Pea
Pomme de terre = Potato
Potasse = Potash
Rutabaga = Swedish turnip
Sainfoin = Saintoin
Sarrasin = Buckwheat
Seigle = Rye
Seigle en vert = Green rye
Tabac = Tobacco
Topinambour = Jerusalem artichoke
Trèfle = Clover
Vesce gesse = Spring vetch
Vigne = Vine

[138]

139 - **Method for Measuring the Transpiration of Living Plants.** — FREEMAN, G. F. in *The Botanical Gazette*, Vol. LXX, No. 3, pp. 190-216, figs. C 5, Tables 6. Chicago, Sept. 1920.

As the result of studies extending over several years, considerable experimental data have been accumulated concerning the transpiration of alfalfa and other plants under various accurately measured conditions of temperature, relative humidity and wind movement.

These data are however very general and it was impossible to say whether a given result was simply the product of the physical factors then prevailing or to what extent it was modified by the physiological reactions of the plant itself. It should be considered possible to calculate from rational formulae the behaviour of a physical evaporating surface for the given conditions. Any departure from the result could then be attributed to the response of the living organism.

The general type of such a formula should remain always the same, but the constants will vary with all the changing conditions of environment, temperature, wind movement, relative humidity etc. The purely physical experiments here reported were designed, first to work out the generalised type of the formula, and then to obtain the constants for certain special cases of environment and other factors.

INSTRUMENTS AND METHOD EMPLOYED. — The evaporating surface used was a porous cup atmometer inclosed in a glass cylinder of 1 litre capacity. A constant stream of air was drawn through the cylinder (over the atmometer) by a rotary air pump. Then the air was measured by a water gasometer which was accurate to 1/1000 of a cub. ft. The dewpoint of the incoming and outgoing air was determined by the interjection of the base of a nickel test tube filled with ether into the air stream. When the ether and tube were cooled to the dewpoint of the air stream, the formation of a film of dew on the outside of the test tube could be seen. A delicate thermometer, having its bulb immersed in ether was then read to 0.1°, which is sufficiently accurate for all practical purposes.

As a result of the effect of evaporation, the dewpoint of the incoming air rises, and hence the transpiration can be calculated. Let y = rise in dewpoint of outgoing over that of incoming air; t = temperature of air; t_1 = dewpoint of incoming air; z = a constant, the value of which depends upon the rate of the air movement. The value of y may then be expressed by the formula $y = z\ (t - t_1)$.

The value of y is proportional to the temperature and increases with the rise of the latter. The agreement of this formula with the experimental results is shown in fig. 1 (p. 166). The line oy gives the calculated value of y. The dots show the experimental results obtained.

The author has been able by means of a series of experiments and calculations, and employing the same apparatus, to calculate the formula to determine the dewpoint in the case of variations in the speed of the air stream, the area of the evaporating surface or of the speed and area combined. The force of the current was measured according to the quantity of air which passed through the cylinder in a given time and was registered by a small gasometer.

The values calculated in this way correspond entirely to those obtained in the experiments.

APPLICATION OF THIS METHOD TO THE STUDY OF THE TRANSPIRATION OF LIVING PLANTS. — Fig. 2 (p. 167) gives the results of an experiment made with a potted alfalfa plant, varying the temperature and maintaining the air stream constant at 70.32 litres per hour, and the dewpoint of the exterior air at 4.8° C. The range of temperature was 17.8 to 36.1° ; the lines $o\ t$ and $o\ t_1$ give the values of t and t_1 respectively ; oy gives the calculated value of y when z (formula $y = z\ (t - t_1)$) equals 7.45 %.

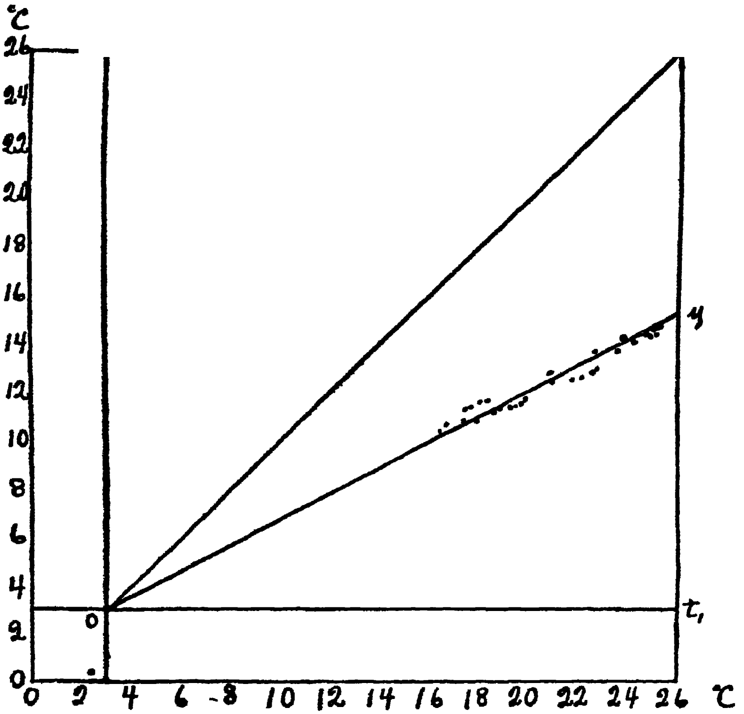


Fig. I.

The data obtained confirm the experimental result (see diagrams) and seem to indicate that under temperature changes of the magnitude here given, the plant acts essentially as a physical evaporating surface.

This method can be employed advantageously in the study of the comparative water loss from different varieties of a single species, and what is still more interesting, between each of the pure descendants of the same variety.

The following data refer to the two races 91 and 17 of alfalfa :—

Date	Race No.	Temperature in cylinder	Dew point of external air	Dew point of escaping air	Relative Humidity of escaping air	No. of sq. cm of leaves	Standard dew point	Excess of race No. 91
May 12 . . .	91	31	— 0.2	19.4	52	91.7	23.0	+ 1.6
» » . . .	17	31	— 0.2	16.2	43	82.8	21.4	—
May 13 . . .	91	27	0.0	17.2	57	97.2	22.9	+ 2.1
» » . . .	17	28	0.0	15.3	48	101.9	20.8	—
May 14 . . .	91	22	+ 3.0	15.7	69	77.7	24.4	+ 0.5
» » . . .	17	23	+ 3.0	15.9	66	79.6	23.9	—
May 14 . . .	91	25	— 1,1	16.9	66	79.4	24.5	+ 0.7
» » . . .	17	24	— 1.1	17.4	64	87.9	25.2	—
May 15 . . .	91	26	— 1.0	17.4	58	71.4	25.0	+ 0.2
» » . . .	17	22	— 1.0	16.0	70	99.5	24.8	—
May 19 . . .	91	26	— 1.3	19.6	61	83.3	25.5	—
» » . . .	17	26	+ 1.3	20.6	71	156.3	24.4	+ 0.6
May 20 . . .	91	30	+ 2.4	23.9	72	75.5	26.5	—
» » . . .	17	30	+ 2.4	24.6	75	103.4	26.0	+ 0.5

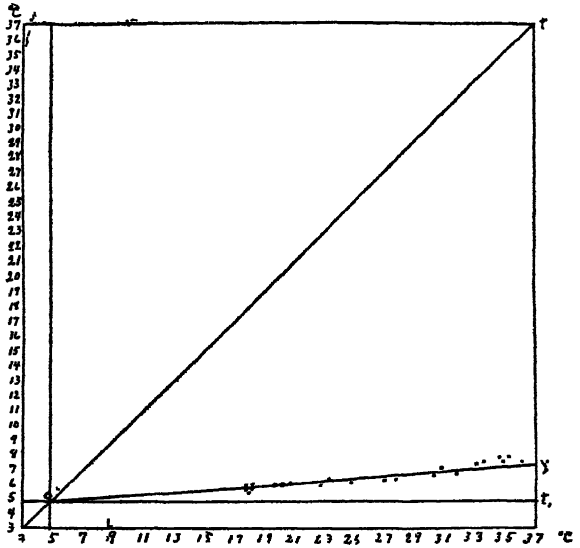


Fig. II.

There are evidently measurable differences in the rate of evaporation per unit area of the leaves of these two races, and this may prove of economic value in semi-arid or irrigated regions.

140 - **Action of Radiations of Different Wave Lengths upon Chlorophyll Assimilation.** — WURMSER, R., in the *Comptes rendus de l'Academie des Sciences*, Vol. CLXXI, No. 17, pp. 820-821. Paris, Oct., 26, 1920.

In a green plant exposed to the sun, a maximum of assilimation of approximately 680 $\mu\mu$ is admitted, but the existence of a second maximum found by ENGELMANN at about 480 $\mu\mu$, has always been disputed. The author has taken up the question, and has used a new method of measuring assimilation, the principle of which was first established by LOEB and OSTERHOUT. It consists in following by means of an indicator (phenolphthalein) the increase in alkalinity of sea-water in the presence of sea-weed exposed to light. The author used a green sea-weed, *Ulva lactuca,* and a red sea-weed, *Rhodymenia palmata.*

In the case of the green sea-weed exposed to day-light, he found that there were two maxima of assimilation. With an equal amount of energy absorbed, the blue radiations are more active than the red (at least 1·66 times). The return is highest in the region of least absorption. It thus seems that the oxygen produced by assimilation is not liberated upon contact with the chlorophyll grains, which would otherwise be rapidly destroyed. Protoplasm seems to be the active element in the reduction of CO_2. The speed of assimilation therefore ought to be so much the greater when, for the same quantity of energy absorbed, the active mass of protoplasm is greater. This happens in regions where a relatively thick layer is necessary to absorb this energy.

The red sea-weed, *Rhodymenia palmata,* assimilates with still greater energy in the green region, as is shown by the following figures, which deal with equal conditions for the two sea-weeds :—

Speed of Assimilation.

	Red light $\lambda > 580\ \mu\mu$	Green light $\lambda = 580\text{-}460\ \mu\,\mu$	Blue light $\lambda < 460\ \mu\mu$
Ulva lactuca	100	24	80
Rhodymenia palmata.	100	50	18

141 - **The Excretion of Toxins from the Roots of Plants.** — MUKERJI, J. N., in *The Agricultural Journal of India*, Vol XV, Pt. V, pp. 502 507, Tables 3. Calcutta and London, Sept 1920.

Some years ago the conclusion was drawn by FLETCHER as a result of field and water culture experiments (1), that crop plants excrete substances from their roots which are toxic to other species as well as to themselves. As the water culture tests were performed with ordinary well water and without control tests, the author considered the evidence inconclusive and repeated the process by substituting the synthetic Knop nutrient solution for the well water :— (Calcium nitrate 4 gm ; magnesium sulphate, 1 gm; potassium nitrate, 1 gm; potassium chloride ·05 gm; ferric chloride traces, dissolved in 7 litres of distilled water; the total salt concentration of this solution being ·11 %) Control tests were also introduced to check results.

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(1) *Mem. of Dept. of Agric. in India, Bot. Ser.*, II, No. 3.

A large number of wheat, *Cajanus*, and gram (*Bouteloua* sp.) seedlings were grown in this nutrient solution, and at the end of a certain period the solution was allowed to evaporate spontaneously until its volume was reduced to about $^1/_8$. The "blanks" were allowed to evaporate to $^1/_3$ and $^1/_4$ the original volume. Jars containing the nutrient solution but bearing no seedlings were also treated in an identical manner and constituted the "blanks." Seeds were then introduced into these concentrated solutions (wheat water etc.) supposed to contain the excretions of plant roots and the progress of crops grown in them was recorded.

The seedlings grown in the various concentrated solutions throve better than in the "blank" test solution, and those grown in distilled water fared best. These observations led to the conclusion that the positive results obtained in the FLETCHER experiments were probably due to the concentration of the salts present in the well water and not to toxic excretions. This was confirmed by an estimation of the "total solids" in the solutions, obtained in the present series of experiments; the values for which are set forth as follows:

Total solids in grams per 100 c.c. "for:— "wheat" water, 0.269, *Cajanus* water 0.154, "gram" water 0.226, blank" water 0.382, and distilled water, nil.

The withering in the case of all 3 crops was hastened with the increase of concentration of total solids.

Former investigations made by various experimentors are mentioned, showing the influence of nutrient solutions covering a wide range of concentration, upon the growth of young plants. The optimum concentration for maize appeared to be about, 0.3 %, and the same for barley and buckwheat. The best concentration for wheat seedlings was placed at 0·03 %. All tend to place the optimum strength of the solution at 0·3 % of total salts. The strength of the solution in the FLETCHER experiment worked out approximately to 1.12 %, a concentration which would doubtless prove toxic to any plant.

The author concludes as a result of his own experiments that the effects ascribed to toxic excretions are, in reality, due to the high concentration of salts in the solutions employed in the final stages of the experiment.

142 - **Researches upon Grafts of *Solanum* spp.** — DANIEL, L., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 22, pp. 1074-1076. Paris, Nov. 29, 1920.

In a previous paper (*Revue bretonne de Botanique*, 1910-1913), the author has shown that the potato, grafted upon other more or less closely related Solanaceae, produces aerial tubers. These tubers vary in number according to the species which is chosen as stock and they are especially abundant when the graft is made with the aubergine and still more with the tomato. In addition, this abnormal formation of tubers depends also upon the nature of the organs taken as scions and upon the environmental conditions, be they natural or due to the grafter.

In 1919, the author gathered about a hundred of these aerial tubers from stocks of the Fluke variety, of Saint-Malo, some grafted upon the tomato, others upon the aubergine. In March, 1920, the author planted these tubers, which he had succeeded in keeping in good condition, in the gardens of the Laboratory of Plant Biology at Rennes, with the intention of studying their comparative development. Although some of the tubers were of small size, all produced plants with leaves; naturally the largest furnished the most vigorous specimens. In July, the author found that plants arising from the graft on the tomato had completely preserved the characters of the variety; themselves early also, they were not distinguished by any particular specific character. On the other hand, those plants arising from the graft on the aubergine were divided into two groups connected by intermediaries; some, the most numerous, had kept the characteristics of the Fluke variety · the others, which were fairly numerous, had become late, and their foliage was still green in September whereas that of the first group had become dry for over a month Thus the aubergine stock, which is late and does not ripen its fruit well in the Armorican climate, had partially transmitted its lateness of vegetation to several aerial tubers of its graft. This transmission, comparable to the action of *Vitis rupestris* upon certain varieties of *Vitis vinifera*, had become hereditary in certain examples by asexual reproduction

Three specimens showed a still more curious heredity Withont a trace of any external influence whatsoever (wounds parasites, particular variation of the environment), there formed at one and the same time aerial tubers and subterranean tubers upon their vegetative apparatus; this simultaneous production did not noticeably reduce the yield of the underground tubers. The agamous inheritance of a character acquired by grafting was in this case particularly clear, although more exceptional than the late character of growth (1).

The author also found that in 1920 all the descendants of the grafted Fluke plant arising from aerial tubers were not attacked by *Phytophthora infestans*

In 1920, the author repeated his grafts of Solanaceae and in particular those of aubergine upon tomato From a scion of the long violet coloured aubergine grafted on the "Merveille des Marchés" tomato, whose fruit is smooth and flat, the author obtained fruits absolutely similar to those of the tomato scion except that they had retained their violet colour. The peduncle, lengthened in the controls, was notably shortened, thus approaching that of the scion tomato On other grafts there were at the same time elongated fruits, short and conical fruits, rounded fruits violet in colour.

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(1) Agamous inheritance consequent upon grafting exists also in the vine, of which useful varieties produced by grafting have been able to be propagated and have been maintained by vegetative reproduction (*Author*)

The variation produced by the symbiosis was more or less complete according to the grafts and was besides exceptional, for the majority of the grafts had not changed.

These phenomena resemble and confirm those obtained by the author in Laboratory of Plant Biology at Fontainbleau in 1895.

At Fontainbleau the fruits of the aubergine were ribbed because the subject tomato scion was taken from plants with ribbed fruit; at Rennes, on this occasion the fruits had become round and smooth because the "Merveille des Marches" is not ribbed. Since the same family of aubergine was in question, there had been, in the 2 cases, a very distinct orientation in the direction of the stock. This orientation allows the influence exercised by one or other of the associates upon its conjoint to be recognised. But this influence does not always exist and the mutual reaction can show itself in other ways, whether by the transformation of a latent character into a dominant character and vice versa, whether by a formation of combinations either ancestral or even essentially new, or by the appearance of essentially new characters. All these phenomena, which the author includes under the general name of "asexual hybridisation" without, however, failing to distinguish between them, have a common origin; they arise from mutual or antagonistic reactions (1) which take place on the level of the callus and at variable distances from it.

143 - **The Inheritance of Glume Length and Grain Length in a Wheat Cross.** — ENGLEDOW, F. L., in *Journal of Genetics*, Vol. X, No. 2, pp. 110-132, Bibliography of 18 works. London, Aug. 1920.

Results of a series of experiments on the inheritance of glume length in a wheat cross, the inheritance of grain length which bears some definite relation to the former and appears to have a marked economic significance.

The author made crosses between *Triticum polonicum* and the variety of *Triticum durum* known as "Kubanka," and studied the parental stocks and the F_1, F_2 and F_3 progeny obtained.

INHERITANCE OF GRAIN LENGTH. — The symbols employed by the author to facilate reference are as follows: —

P = *Triticum polonicum.*

K = variety Kubanka

I = heterozygous glume type proceding from the cross P × K and is roughly speaking, intermediate between the two parents.

F_0. P = population of pure parental Polish type employed in the cross.

F_0. M_p (glume) = mean glume length of a population of parental *T. polonicum* origin.

F_0. σ_p (glume) = standard deviation of the glume length.

The biometrical values recorded, correspond to the total of 8 measurements.

PARENT VARIETIES. — The results obtained in 1913 and 1914 may be summarised as follows: —

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(1) See *R.* April 1920, No. 403. (*Ed*)

Year	Variety	Mean glume length	σ	Number of observations
1913	*T. polonicum*	$F_0 . M_p = 28.6 \pm 0.34$	—	80
1914	»	$F_0 . M_p = 30.84 \pm 0.10$	3.784	600
1913	« Kubanka »	$F_0 . M_k - 11.23 \pm 0.24$	—	25
1914	»	$F_0 . M_k = 11.70 \pm 0.04$	1.260	400

F_1. — During 1914-19 the F_1 measurements were lost, but according to the author's observations and those of other investigators the F_1 mean occupied an intermediate position which was attributed to the glume length and the F_1 value was probably 21.27 mm.

F_2. — Although 530 F_2 plants were raised, only 487 of them furnished grain for the raising of an F_3 (See table) :—

Class means	No. of plants	Class means	No. of plants
9.5	12.5	20.5.	16.0
10.5	28.0	21.5.	13.5
11.5	47.5	22.5.	15.5
12.5	24.0	23.5.	10.5
13.5	25.5	24.5.	14.0
14.5	38.5	25.5.	7.0
15.5	46.0	26.5.	10.0
16.5	75.0	27.5.	5.0
17.5	43.0	28.5.	1.0
18.5	35.0	29.5	
19.5	13.5	30.5.	1.0
		Totals	**467**

Two conclusions may be drawn from these data :

(1) Three glume-length types appear in F_2.

(2) None of these types corresponds exactly to the *T. polonicum* parent.

To distinguish between these 3 types, the author adopted the mathematical analytical method and thus calculated, the frequencies of the F_2 types were :—

	K	I	P
Number of plants	23.29 %	57.76 %	18.94 %
Modes	11.5 mm.	16.5 mm.	24.5 mm.

F_3. — The F_3 plants were kept in families, an F_3 family consisting of all the plants raised from the grain borne by any one F_2 mother plant.

From the nature of the F_3 family the genetic type of the corresponding F_2 plant was judged. Thus an F_3 family on which all the plants were P, must have originated from a homozygote P plant of the F_2. An F_3 family, however, containing plants of two or more types (*e. g.* P, I, and K ; or P and I, etc.) must have come from an F_2 plant that was heterozygous *i. e.* an I plant

In the sorting of the types of the F_3 families, measurable (quantitative) type standards were considered preferable to mere eye-judgment.

For an F_3 family regarded as K, the value of 15 5 mm was finally adopted as an upper limit However, every plant of every family proved to be to the judgment of the eye, of K type in appearance, even when the glume length was less than 15 5 mm. The metrical standard was therefore, thus far, applicable.

F_3 families were accepted as P if they contained no plant of glume length less than 19 5 mm. This was found, however, inadequate for practical purposes, and after full trial, the metrical standard was abandoned in the case of the Polish and instead eye-judgment was adopted. *T. polonicum* and Kubanka are so distinct in glume form, that the practised eye has little difficulty in separating the homozygote (K and P) from the heterozygotes (I).

According to the standards adopted the F_3 is constituted as follows . —

$$F_3 = \left\{\begin{array}{l} 114\ \text{K families} = 1237\ \text{plants} \\ 267\ \text{I families} = 2854\ \text{»} \\ 101\ \text{P families} = 1054\ \text{»} \end{array}\right\} = 5145\ \text{plants.}$$

Regarding all F_2 plants as simple heterozygotes, if in their F_3 families, there occurred more than one type, and denoting the heterozygote by the letter I, the F_2 ratio is :

K	I	P	Total
114 plants	267 plants	101 plants	482 plants
	55·39 %	20 95 %	100 %

A ratio of 1 2 : 1 therefore holds good among these types, on the assumption of a 1-factor difference.

Consequently as a working hypothesis it is assumed that either P or K possesses a factor for glume length which the other lacks, and that the heterozygote is, broadly speaking, intermediate between the parental forms.

INHERITANCE OF GRAIN LENGTH. — It has been ascertained that on any plants, K glumes were invariably accompanied by K grains, and similarly for I and for P. Consequently in F_2 and F_3 the classification by glumes was accepted as a classification by grains.

Grain lengths of parental varieties. (F_0.P and F_0 K). — In successive generations the grain length distributions were,

F_1. — Grain measurements were lost. From memory and from previously published investigations it is concluded that the heterozygote length is roughly intermediate between the parental ones.

F_2. — It should not be forgotten that the grain K, I or P implies the plant possessing analogous glume types, since it has been admitted that glume length and grain length are genetically inseparable and are governed by the same factor. Glume-length showed segregation in F_2 as was made clear by examination of the F_3 progenies of the F_2 plants. The vindication of this assumption necessitates a demonstration of the segregation of grain length in F_2 similar to that given for glume length.

Frequency distributions of grain lengths F_2 *and* F_3 *and parents.*

Class means	F_0.P	F_0.K		F_2
mm.				
5.5	—	2	—	4
6.0	—	—	—	19
6.5	—	9	3	53
7.0	—	47	11	94
7.5	—	111	32	207
8.0	4	187	89	324
8.5	7	36	127	321
9.0	37	2	151	343
9.5	56	1	67	199
10.0	165	—	7	76
10.5	154	—	—	4
11.0	84	—	—	—
11.5	18	—	—	—
12.0	1	—	—	—
Totals	526	395	487	1644

The F_2 distribution is unimodal but it would appear that "shift" has occurred. The author considers that possibly the distribution consists of 3 constituents which lie very close on account of the shift, and which, by marked overlap, produce unimodality of the whole.

F_3. — The measurements and numbers of plants correspond with those for glume length.

It may so far be concluded that:—

(1) the one factor which governs the P-K glume difference also governs the P-K grain difference;

(2) "Shift" occurs, so that the P and K types as seen in F_2 (glume and grain) are numerically shifted forms of the true F_0 type.

The shifted values persist in F_3 (See Column 4 of preceding Table).

(3) In spite of the demands of the double fertilisation theory, the grain appears in so far as its length is concerned to belong to the same generation as the plant on which it is borne, *i. e.* grain length is a maternal character and segregates on the 1 : 2 : 1 basis in F_2.

CONCERNING THE APPARENT GENETIC INSEPARABILITY OF CERTAIN CHARACTERS IN THE CROSS. — Glume form like grain form is the resultant of a number of characteristics, and since the resultants are inseparable, so also must the constituents be inseparable.

A list of inseparable constituent characters is here given :—

1) Length of glume.
2) Ribs on main lamina of glume.
3) Shape of tip of glume.
4) Curvature of keel of glume.
5) Consistency of material of glume (P is " papery ", K is more rigid).
6) Length of grain.
7) Shape and size of cross-section of grain.
8) The angle at which the embryo of the grain is set in the endosperm.
9) Number and length of the hairs at the apex of the grain.

144 - **Some Superior Varieties of Swedish Barley obtained by Line Selection or by Hybridisation.** — NILSSON-EHLE, H., in the *Landtmannen Tidskrift for Landtmann*, Year II, No. 45, pp 723-724, and No. 46, pp 743-745. Stockholm, November, 1920.

NEW VARIETY OF BARLEY WELL-ADAPTED TO CONDITIONS IN SWEDEN. — This refers to variety " 0412 " obtained by selection, from Chevalier and surpassing it in yield, owing to its stronger straw and earlier maturity.

Compared with " Princess," one of the most favoured varieties at the present time, 0412 produces equally well, matures earlier and possesses stronger stems. There is a promise, therefore, of a distinctly satisfactory combination of characters; it is only slightly inferior to " Gullkorn " as regards date of maturity. This new type is also remarkably resistant to *Heterodera schachtii*, to which Gullkorn and Princess are, on the contrary, generally liable.

Practical cultivation trials carried out on a large scale from 1910-1919 in the Malmöhus district certainly confirm the above statements, and support the claim that 0412, like Princess and Gullkorn, is one of the best varieties tested so far in southern Sweden; these three types can reciprocally replace one another in accordance with the special local conditions, geological and climatic.

DEGREE OF RESISTANCE OF THE DIFFERENT VARIETIES OF BARLEY TO *Helminthosporium gramineum*. — Amongst the more common varieties distinct differences have been observed and controlled experimentally with regard to their resistance to *Helminthosporium*. The Tystofte Korsbyg variety (Danish) occupies the first place as regards resistance. In a series of tests carried out by D. PETERSON at Köpenhamm, Tystofte Printice showed 8 % of infected plants, Julibyg 8 %, Fredriksens Grad Byg, 23 % Karlsbyg, evidently the most liable to attack, 48 %. It might be possible, however, by the aid of opportune crosses, proceeding from Tystofte Korsbyg, to obtain resistant types, with other desirable characters at the same time.

In any case, the character of resistance is subject, like all other characters, to the phenomena of splitting which make the work of fixing the types a tedious process. By crossing types of an average resistance, transgression phenomena are often liable to occur with the appearance of plants that are more resistant than the most resistant parent and more susceptible than the most susceptible parent.

Thus, in the F_2 of the Chevalier × Gullkorn cross studied in 1919 at Åkarp (Sweden), a considerable number of infected plants were observed, whilst the parents were practically all immune; this may perhaps be due to local conditions, but in any case, this phenomenon should be kept in sight, as the possibility of a negative transgression cannot be excluded.

The investigations made by KIESSLING at Weihenstephan (Bavaria) confirm the results obtained by Danish and Swedish investigators. Although the actual percentage of diseased plants may vary in limited areas from one year to another and from one locality to another, according to local conditions, the heredity of the character of resistance manifests itself each time with absolute certanty. The investigations made by KIESSLING also demonstrate the existence of resistant and susceptible varieties in every group; *nutans*, *erectum*, etc. The general opinion that attributes the most marked degree of susceptibility to the *erectum* type is completely erroneous.

Resistance can evidently be associated with morphological characters which serve to differentiate between the various groups.

RESISTANCE TO *Heterodera schachtii* AND ITS SIGNIFICANCE FROM THE PRACTICAL AGRICULTURAL STANDPOINT. — This nematode, as is welknown, has a considerable influence on the crop rotations adopted in Swe-den (especially on miocene clays) and in the Danish islands. Oats are obviously the most susceptible, although the other cereals may also be attacked. The most efficacious means of control used up to the present consists in intercalating hoed root crops *e. g.*, sugar beet in the rotation or other refractory crops such as leguminoseae. However, this method is not really sufficient, one reason being that certain forage Gramineae included in the rotation are also to some extent liable to attack.

It is therefore important, from the economic standpoint, to be able to make use of grasses that are completely refractory, as catch crops in rotation with beets and legumes.

A fact worthy of attention is that, up till now, no difference has been observed with respect to *Heterodera*, between the different varieties or types of wheat or oats, as all possess practically the same degree of susceptibility.

Distinct differences are evident, however, between the various sorts of barley at present cultivated. The first symptoms of this were revealed by the fact that the yield of oats varies according to the variety of barley which precedes it in the rotation. In fact, a long series of cultural tests at Skania showed that the yield of oats varied from 2900 kg. per hectare to 1800 kg., according to whether the oat crop had been preceded by resistant or susceptible types of barley.

The choice of varieties of barley resistant to *Heterodera* is therefore possible and is of the greatest importance from the economic point of view.

The Chevalier variety as well as Primus, Svanhals and 0412, is refractory but has the disadvantage that it produces less, matures late, and has somewhat weak straw.

The best producers, Gullkorn and Princess, are, on the contrary, very susceptible.

The researches undertaken by the author appear to indicate that resistance depends on a single genetic factor and as the characters of earliness, strong straw, etc, can easily be separated and re-combined, it will not be impossible to obtain, after a certain time, by means of crosses and suitable selection, etc., types which, being resistant to *Heterodera*, possess also to a marked degree the other desirable characteristics.

Attention is drawn in this respect to the researches made by ORTON in the United States. In the Southern areas, *Vigna sinensis* is largely cultivated: but certain types of *V. sinensis* are refractory to another nematode very injurious to the cotton, namely, *Heterodera radicicola*. If this resistant variety is introduced into the rotation, the damage caused by *Heterodera* to the cotton plantations can be considerably attenuated.

" ASPLUND " BARLEY. — In 1903, G. ASPLUND, of Viby, Västmanland (Sweden), noticed in a field of barley of the Primus variety, mixed with common 6-row barley, a plant which could be distinguished from all the others by its peculiar characteristics. This plant was isolated and reproduced until it was eventually introduced to the trade in 1910 by the Seed Association of Hälland; this variety has also been introduced and tested in Denmark, and particularly in Norway, where it gave excellent results. " Asplund " is distinguished by its high content of starch and fats, but it does not reach quite the same standard as regards proteins. Its good qualities, and particularly its short and strong straw, show up on very rich and well manured land, and under moist climatic conditions. This last circumstance accounts for the popularity and wide distribution of this new variety in the very moist southern and western districts of Norway.

As to its origin, it appears possible that it proceeds from a natural cross between Primus and the Common 6-row barley (indigenous to Northern Sweden), which, as already mentioned, was found more or less in combination in the field where the original plant was found.

The high yield may thus derive from Primus and the early ripening from the native barley; the latter quality makes it possible to grow this new variety successfully very far to the north.

The author intends to make a special study of the origin of Asplund at the Genetic Institute (Southern Sweden).

145 - **Inheritance in Barley: The Lateral Florets and the Rachilla.** — ENGLEDOW, F. L., in *Journal of Genetics*, Vol. X, No. 2, pp. 93-108, Bibliography of 10 works. London, Aug. 1920.

In the barleys, the rachilla may be bristly, well supplied with long hairs or smooth with short fine hairs. From the cross *Russian Chevalier* No. 7 × *English Archer*, 2 rows of both, the first smooth and the second bristly, in the F_1 bristly plants were obtained (*Archer* type) and in F_2 out of 546 plants, the ratio was bristly: smooth = 410: 136 (3:1 ratio).

In a similar way, the cross *Russian Goldthorpe* No. 10 × *Inerme* gave in F_1 bristly (*inerme* type), and in F_2 bristly and smooth ratio, 3 : 1.

The presence or absence of hairs on the rachilla is then, governed by one factor.

A series of crosses between barley varieties (2-row) and others (6 row) demonstrated that different forms of lateral floret in hybrid generations exist distinct from the parent forms. Taking as example *H. hexastichum*;

(*A*) Lateral floret always fertile, the grain being nearly as large as that formed by the median floret; *distichum* barley (*F* type) non fertile; outer palea always rounded and awnless; stamens and a very small shapeless ovary.

In hybrid generations, there are apparently certain forms which have no connection with any of the parents. The following types exist:

(*C*) Fertile; grain small; outer palea terminating in an awn which may be merely a point or up to 3 cm. long. This type appears to be a heterozygote.

(*D*) Non-fertile, but inflated; outer palea pointed or with short awns; stamens and reduced ovary.

E) Non-fertile, but large and inflated; outer palea always rounded and devoid of an awn; stamens and reduced ovary.

G) Non-fertile and extremely reduced; small outer palea and a rudimentary inner one; no traces of rachilla or reproductive organs.

The F_2 type of lateral floret obtained by cross between 2-row and 6-row barley gave as average:

Homozygote (*A*) 6-row	398 plants
Heterozygote	821 »
Homozygote (*F*) 2-row	392 »

Ratio 1 : 2 : 1.

146 – **The Inheritance of an Abnormal Haulm Type in Potatoes.** — SALAMAN, R. N., and LESLEY, J. W., in *Journal of Genetics*, Vol 10, No 1, pp. 21-36 Pl 2. London, July, 1920.

In 1906 the potato variety Queen of the Valley was fertilised by Flourball. One of the F_1 seedlings was fertilised in its turn by a seedling arising from a selfed ball of Bohemian Pearl. This gave rise to a family which was grown in 1909, one of whose units (M_5 B_{35}), selfed in that year and produced a type characterised by a " prostrate " habit.

The stems instead of standing erect, lay along the ground; When handled the stems themselves felt like soft rubber tubes. The article under consideration contains the results of study both anatomical and genetical, in connection with this new type.

I. ANATOMICAL STRUCTURE. — The most outstanding difference between the normal and abnormal type is associated with the xylem, which with a normal stem forms a continuous ring of woody tissue in the interfascicular region or medullary rays; the xylem in the second case was either deficient or entirely wanting. Owing to the deficiency of sclerosed tissue, the stems were not capable of remaining upright and were obliged to creep horizontally along the ground.

GENETIC RELATIONS. — The origin of the "prostrate" plants may be traced back to 3 cultivated varieties. Flourball, Queen of the Valley and Bohemian Pearl; the direct parent stock M_5 B_{35} mentioned above has been lost. In the study of the genetical characters, attention is therefore confined to the progeny. The "prostrate" variety not only breeds true but reproduces itself without variation through the buds of its tubers.

The authors made crosses of type Upright × Prostrate, and Prostrate upright, choosing specimens in which the differential character is fixed and constant from the genetical standpoint.

In F_1, 914 upright and 13 prostrate were obtained.

(The 13 Prostrates were partly derived from 3 families possessing the following ratio: Upright: Prostrate = 79 : 6; 39 : 6 and 91 : 1.).

The normal upright character evidently behaves as a dominant. The incomplete dominance observed in the 3 F_1 families mentioned, may possibly have been due to faulty technique during the pollination process.

In F_2, 826 upright to 13 prostrate were notified, or approximately 63 : 1. The selfed F_2 plants gave in F_3, upright and prostrate in the following proportions: —

Upright	Prostrate	Upright	Prostrate
10	3	26	—
35	1	9	—
38	3	7	1
24	—	—	—

Now, if, as the proportion in F_2 led us to suppose, the "upright" and "prostrate" parents differ in 3 factors, any one of which in a single dose gives "uprightness," F^2 uprights when selfed should prove of 4 distinct kinds: pure "uprights"; impure "uprights" of 3 distinct kinds. More than half $\left(\frac{37}{63}\right)$ will be pure "upright"; the remainder $\left(\frac{26}{63}\right)$ impure; of these latter nearly half $\left(\frac{12}{26}\right)$ will yield "uprights" and "prostrates" in the ratio of 15 : 1, about one third $\left(\frac{8}{26}\right)$ should give 63 : 1, and the remainder $\left(\frac{6}{26}\right)$ 3 : 1.

The data collected clearly indicate the phenomena of segregation of characters; however, the material so far analysed is insufficient to construct any definite gametic formulae.

CONCLUSION. — The procumbent "prostrate" variety is associated with a deficiency of xylem. The differential character is determined by several factors, probably 3 in number.

147 - **Hybridisation Trials with Certain Lines of Deli Tobacco, at Medan, Sumatra.** — HONING, J A, in the *Mededeelingen van het Deli Proefstation*, Series 2, No. X, pp 1-41. Medan, 1920.

Results of several hybridisation trials with the following strains of Deli tobacco: —

Light brown No. 72: — Abundant foliage; brown colour after fermentation.

Line 774: — Many elongated leaves, but somewhat narrow at the base; late flowering.

Pale No. 1: — Leaf blades light — coloured, shining, long and wide, especially at the base; after fermentation, turning light brown or reddish green.

Dark. No. 3: — Leaf blade rather shorter and darker (brownish-green, reddish-brown) than Line No. 1.

I. — From the cross between the 2 lines, Nos. 1 and 3, in F_1, the progeny was homogeneous and possessed intermediate characters. In F_2 and F_3, a dissociation of characters was evident with the appearance of intermediate individuals and individuals showing the parental characters.

II. — Cross No. 1 × No. 72. No 1 possesses the advantage over No. 72 of having somewhat thicker foliage and very long blades. No. 72 possesses, however, abundant foliage and a good colour. The cross was made for the purpose of combining, if possible, the characters of the 2 lines in one fixed type.

The hybrids of F_1 produce on an average 1 or 2 leaves more than strain No. 1. As to the length and width of the leaves, these are very similar to those in line No. 1, whilst the number of dark leaves is greater with the hybrids than with No. 1.

It may be concluded that the hybrid descendants give in F_2 a mixture of types, some of which closely resemble the parents. Several characters are combined and limit the possibility of obtaining positive results by means of hybridisation; for example, plants with leaves broad at the base flower earlier than those with a constricted base.

III. — Cross. No. 1 × No. 774 is characterised by a larger number of leaves (8 or 9), by a more constricted leaf-base and by late flowering. In F_1, and F_2, roughly the same number of leaves are produced as in No. 1, The character "numerous leaves" appears to be completely dominant. As regards length of leaf blades, the F_2 resembles No. 1 (slightly behind as compared with No. 774) and, as regards width it has intermediate characters, although the differences are negligible.

Most of the F_2 progeny have the narrow leaves of the parent No. 774; the data apparently indicate that there is a segregation of characters regulated by two factors, and that the character "c ns ricted base" is dominant. Here also the latter character remains united to the character "late flowering," and perhaps even to the character "abundant foliage".

148 - **Bud Variations of Cultivated Trees and Shrubs as the Cause of the Deterioration of Fruit-Tree Varieties.** — CHEVALIER, A. (Directeur du Laboratoire d'Agronomie Coloniale de l'École pratique des hautes études), in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 21, pp. 1011-1014. Paris, Nov. 22, 1920.

Bud variations often due to heredity occupy a high position in the plant world, as is shown by the important bibliography dealing with this subject by P. J. S. CRAMER (*Kritische Uebersicht der bekannten Fäll von Knospenvariation*, Haarlem, 1907). Attention has since been particularly drawn to the improved new varieties derived from bud variations in cultivated plants that have been propagated asexually from remote periods, *e. g.*, banana, sugar cane, potato, etc.

The author sets out to demonstrate that bud variation is also a cause of the deterioration of improved varieties propagated asexually for many years. These variations occur unexpectedly as the tree becomes old, as BLARINGHEM has shown (Les complexes végétaux et leurs disjonctions par la veillesse, *Annales de l'Institut Pasteur*, Vol. 32, No. 2, Feb., 1918), or through mishap, lack of care, or even after the transport of the individual tree far from its native country.

With reference the maple with variegated leaves (*Acer Negundo* L. var. *foliis argenteo-variegatis* Hort.), it is only rarely that green suckers are formed. Nevertheless, this variety occasionally shows a tendency to revert to the type with green leaves. In the summer of 1920, during a visit to the devastated areas, the author noticed that, at Saint-Quentin at la Fère and at Noyon, all the Negundo maples with silver leaves, growing in the invaded area, with lopped branches and in a generally dilapidated condition, produced a large number of branches with green leaves. One mutilated specimen growing at Noyon, outside the cathedral, was especially noticeable in this respect. In October last, it produced at the same time branches with variegated leaves and others with green leaves intermingled, indicating, therefore, a veritable disjunction. The two types of branches bore normally developed fruit.

In Paris, a species of *Myrtus communis* L. with large opposite leaves, is grown, propagated sôlely by cuttings. On a specimen at Domfront (Orne), the author noted the appearance of a feeble branch with verticillate leaves in threes, thus resembling the variety used in Jewish cermonies (H. DE VRIES).

In Normandy the author observed also a Bigarreau Cherry, nearly a hundred years old, with a branch that had fruit spurs, bearing small bitter cherries, and a pear tree without thorns with some branches that bore fruiting branches with thorns, evidently a reversion to the ancestral type *Pyrus Pyraster* Borau.

Certain old varieties of the cider apple, propagated exclusively by grafting for several centuries, have remained unchanged in certain localities, whilst in others, they are on the downward grade (less fertility, less resistance to disease). The olive which has been propagated asexually since the very earliest times, has reached a state of senility, whch frequently leads to the formation of excrescences, true bud variations that imply the decadence of the varieties both physiologically and sometimes morphologically.

It is therefore necessary to regenerate the varieties cultivated since ancient times and to attempt to reproduce them by self-pollination and from seed. When selecting a grafting stock, it is necessary to make sure that the branch from which it is proposed to remove the graft possesses the true characters of the variety in question. The grafts should thus be taken from young and vigorous stock and all those coming from suckers or from excrescences or from fallen branches should be discarded.

149 – **Methods for Differentiating between the Seed of Mangolds and Sugar-Beets** (1). — PIEPER, H., in the *Zeitschrift des Vereins der Deutschen Zuckerindustrie*, Nov. 1919; reproduced in *Deutsche Landwirtschaftliche Presse*, No 1, pp 3-4, 1920.

In most cases, the glomerulae of the mangold can be readily distinguished from those of the sugar-beet after germination (not before), by the colour of the plumule, above and below ground, by the radicle leaves, etc.

It is sufficient therefore to conduct germination tests by burying the seeds 2 cm. deep in small receptacles containing garden soil, exposed to diffused light, covered with sheets of glass (uncoloured) and at a temperature of 15° C. After 8 days, when the first shoots appear the sheets of glass should be removed, and the seedlings watered, if necessary. After 2 or 3 weeks, the seedlings are 2 to 3 cm. high and the process is ended.

For examination purposes, the seedlings are pulled up whole and examined individually on a black plate, comparing them with seedlings possessing definite characters proper to the sugar-beet.

In the sugar beets, the hypcotyl is colourless and the epigeal portion is generally (80 %) rose-coloured or greenish white (some 20 %).

In mangolds with yellow or orange coloured roots, the stems are either entirely yellow, or distinctly orange, with slight shades.

In mangolds with red roots, the stems are distinctly carmine in colour which increases in intensity from the first foliage leaves downwards.

The only mangolds which may be confused with sugar beets are those with white roots and the Lank variety, owing to the similarity in stem coloration.

150 – **Varietal Experiments with Spring Wheat on the Northern Great Plains** (2). — CLARK, J. A., MARTIN, J. H. and SMITH, R. W. (Office of Cereal Investigations) in the *United States Department of Agriculture, Bulletin* No. 878, pp. 1-47, Tables XXI, Pl. 3, Bibliogr. of 15 works. Washington, D. C., Nov. 9, 1920.

A summary of the results from " Field Stations ". The average annual precipitation at the various Stations during the period 1913-1919, inclusive, was between 13 and 19 inches. These experiments were conducted in order to determine the varieties best adapted for growing in this semi-arid region. Drought and diseases occurred in several of the years, causing premature ripening, low yields and poor quality of wheat. By means of the complete records kept, in addition to yield, data on the following important factors were obtained concerning days from emergence to maturity, height of plant, percentage of stem rust infection, weight per bushel, percentage of crude protein, yield of flour, and volume of loaf.

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(1) Method first adopted by the *Verein der deutschen Zuckerindustrie.*

(2) See *R.* Sept. 1915, No. 907 and *R.* March 1917, No. 237. (*Ed.*)

Two classes of wheat were grown, namely common and durum. The former was represented by hard red spring varieties considered best for bread making. The latter generally gave a higher yield and were more resistant to rust and drought, but although in in some cases yielding a higher percentage of flour than common wheat, equal or superior to the latter in crude protein, they possessed a weak gluten.

A comparison of the various results showed that in general, the Marquis (1) was the leading yielding variety amongst the common wheats. It is short strawed, early maturing and has the highest milling and breadmaking value. (The average yield of flour from 37 samples was 70.2 %) This variety was therefore used by the authors as the standard of comparison Of the other commercial varieties the Power Fife with an only slightly inferior milling value, gave larger yield and greater height than Marquis in north-western North Dakota and north-eastern Montana. The Preston yielded less, was more liable to rust, but matured nearly as early, and had a greater bushel weight. Few new varieties compared favourably with Marquis The early maturing varieties Prelude and Pioneer escaped summer drought in some seasons and possessed good milling and baking value. In a limited number of Experiments, Kitchener, Ruby and Kota varieties showed promise of being even superior in quality to Marquis.

Of the two widely grown commercial varieties of durum wheat, Arnautka and Kubanka, the latter proved superior in yield, rust, resistance, and milling and baking value. The Poliss gave the highest yield in the western portion of the Great Plains area. The Acme and Monad were superior and showed the highest percentages of flour of any of the durum wheats, as compared with Marquis, being higher by 2.5 % and 2.4 % respectively. The D-S variety (Red Durum) was the most rust resistant variety grown but had poor milling value.

151 - **Qualities of Some Selected Swedish Barley Varieties.** — See No 144 of this *Review*

152 - **The Growth of Rice as Related to Proportions of Fertiliser Salts added to Soil Cultures.** — TRELEASE, S F. (Department of Plant Physiology, College of Agriculture, Los Baños), in *The Philippine Journal of Science*, Vol. 16, No. 6, pp. 603-627, Fig. 5, Bibliogr. of 16 works. Manila, June 1920.

The author deals with the growth of rice plants in soil cultures to which phosphorous, nitrogen and potassium were added in various proportions. The addition of these elements was made by means of three salts namely: primary calcium phosphate (Ca $(HPO_4)_2$ ammonium sulphate $(NH_4)_2 SO_4$) and potassium sulphate ($K_2 SO_4$).

For these tests rice was employed (variety "sanglay puti") growing in a water-saturated soil, in culture vessels having a capacity of approximately 19 litres each. To each culture a sufficient quantity of salts was added to give in 19 litres of water a total osmotic concentration of approximately 0.5 atmosphere at 25° C.

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(1) See *R.* June 1918, No 641, and *R.* Dec. 1918, No 1349 and *R.* Feb. 1919, No 190 (*Ed.*)

Results. — The plants in all of the cultures made vigorous growth compared with the control cultures. The colour differences became conspicuous about 3 weeks after trasnsplanting. At this time the cultures having 0.1. and 0.2 of their total osmotic concentration due to ammonium sulphate were small and were light green in colour; those having 0.3, 0.4 and 0.5 due to a similar cause were a medium shade of green; and the cultures having 0 6, 0.7 and 0.8 of their total concentration due to this salt were a very dark shade of green. The plants that were medium and dark were apparently the most vigorous and made the most rapid vegetative growth, and produced the largest number of stools and the broadest leaves. These differences in colour remained noticeable until several weeks after the time of flowering, when all the cultures became yellower in colour and the differences less marked.

The triangular diagram showing the relative dry yields of tops brings out some interesting relations between the proportions of the salts supplied to the soil and the resulting plant growth as indicated by the production of dry tops. The area of high yields includes the cultures characteriseed by the highest proportions of $(NH_4)_2\ SO_4$ and it is evident that no high yields were obtained when this salt made up less than 0.4 of the total osmotic value of the salt mixture nor when $Ca\ (H\ PO_4)_2$ comprised more than 0.5 of the said value. The highest yield of tops was obtained with a culture having the following fertiliser mixture: 0.0154 gm. molecule of $Ca\ (HPO_4)_2$ 0.1228 gm, molecule of $(NH_4)_2\ SO_4$, and 0.0154 gm. molecule of $K_2\ SO_4$. The yield of tops with the control culture, which was without fertiliser was only 19 % of that obtained with the above mentioned culture. The highest grain yield was also obtained with this culture.

The lowest yield of tops and also of grain were obtained with cultures containing the lowest proportion of $(NH_4)_2\ SO_4$ tested, and low proportions of $Ca\ (H\ PO_4)_2$, but with high proportions of $K_2\ SO_4$. A very slight, but probably not significant, improvement resulted from the addition of these poorest salt mixtures to the soil, since the grain yield obtained was slightly higher than the average yield from the control cultures

A comparison between different kinds of plant neasurement is illustrated in graph form.

In the study reported by the author only one total concentration of the fertiliser salts was tested, and it is suggested that similar experiments should be conducted with a range of total concentrations from the very low to the very high values, in order to make it possible to determine approximately, the optimum proportions of the fertiliser salts at the optimum total concentration and consequently the best proportions for the growth of rice plants under the general conditions of these experiments. The importance of further investigations in this respect is emphasised.

153 - **Importance of Lupin Cultivation.** — See No. 119 of this *Review.*

154 - **Modifications in the Usual Form of Cultivation of Potatoes.** — Schribaux, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol VI, No 39, pp 930 934 Paris, Dec 22, 1920

Report of information received from Dr Maisonneuve giving an account of comparative tests carried out at Angers with the potato, using 1) whole sets · 2) cut sets weighing 8 to 10 gm with one eye

The cut sets were exposed to the sun for 102 days, in order to allow the wounds to callus, and were then planted in rows 12-14 cm between the sets

Four experiments out of 5 gave results indicating that small and medium cut sets give higher yields than whole sets In the first test, the medium cut sets produced 40 % more than the whole sets and gave larger tubers In the second test, the small cut sets gave 80 % more than the whole sets

M Schribaux remarks that he has already had the opportunity to notify similar results Evidently it has to do with a fertile area The question still lies open as to the behaviour of these different methods of cutting relative to various soils, weather conditions, varieties, etc

155 - **Brazilian Manioc.** — Guimarães, F, in the *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year VIII, pp 167 170, Rio de Janeiro, 1920

Analyses were made of 5 specimens of Manioc (1), in the chemical Laboratory of the "Museo Nacional do Rio de Janeiro" The results obtained are set out in the following table —

Variety	Bark	Original material						Dry material				
		Moisture	Ash	Protein	Fats	Cellulose	Starch	Ash	Protein	Fats	Cellulose	Starch
	Per cent											
Yuca Maltingir (12 Months)	13 12	69 22	1 21	1 01	0 61	0 92	27 03	3 94	3 31	1 99	2 99	87 77
Yuca Campista (9 Months)	12 03	65 22	0 78	1 25	0 53	0 83	34 39	2 25	3 68	1 54	2 41	90 12
Yuca Orandy (8 Months	13 44	63 98	3 80	1 06	0 51	1 48	32 17	2 24	3 00	1 43	4 11	89 2[illegible]
Yuca Maltingir (7 Months)	10 26	63 16	1 01	1 18	0 56	0 99	33 10	2 75	3 25	1 54	2 42	90 04
Yuca Manipeba (12 Months)	10 1[illegible]	66 [illegible]	0 98	0 62	0 46	0 65	31 00	2 9[illegible]	1 87	1 37	1 94	91 89

(1) See Carl, A, Cultura da Mandioca *Ministerio da Agricultura, Industria e Commercio, Serviço de Informações e Divulgação* pp [illegible]1, Rio de Janeiro, 1914 Manioc constitutes one of the principal food crops of Brazil, where there are 99 varieties 41 in the State of Goyaz, 27 in Minas, 11 in Bahia, 10 in Rio de Janeiro, 7 in Parana, 7 in Matto Grosso, 7 in St Paulo, 6 in Para, 4 in Ceara and 2 in Piauhy The importance of this product not only for home consumption but for export is shown in the following table (amounts in metric tons)

	1915	1916	1917	1918	1919
Manioc flour . .	4 629	5 370	18 745	65 322	21 834
Manioc roots .	—	—	33	3 313	226

(*Ed*)

156 - **Cultivation and Use of " Kudzu" *(Pueraria Thunbergiana).*** — SIENT, S. M (Division of Botany, Pretoria), in the *Journal of the Department of Agriculture, Union of South Africa*, Vol. 1, No. 6 pp. 558-560. Pretoria, Sept. 1920.

This woody climber, Natural Order *Leguminosae*, is a native of Japan, where the starch in the roots is used for human food and the stems contain a fine fibre suitable for cloth manufacture, and the foliage is used as stock fodder, especially for horses. It has been cultivated as an ornamental plant in the United States but only quite recently as a forage crop. Reference is made to the experiments carried out at the Louisiana Agricultural Experiment Station etc. reported by PIPER (Department of Agriculture, Washington), who also lays special stress on the fact that although the value of the plant both for hay and grazing is acknowledged, investigations are still necessary to prove its habits and behaviour under varying conditions, before a definite opinion can be given. The feeding value is about equal to clover and lucerne.

Setting the rooted plants in the field where they are to be grown was found the best method, and preferable to seeding or propagation by cuttings. The largest crops were not obtained until the third season and subsequently. As " Kudzu " is a long-lived perennial it is advisable to plant it only where the field can hold this crop for several years. Soyabeans, cowpeas or peanuts can be grown between the rows during the first season, to avoid losing the use of the land.

The crop was found best suited to pasture land for cattle in preference to hogs, and was proved excellent for soiling and for green feeding. A yield as high as 10 tons per acre of hay was reported in Northern Florida, yielding three cuttings of hay per season. The hay cured more easily than most legumes, as the leaves are less juicy. If properly cocked, the hay shed rain without the use of any topping material. Even cocks left all the winter were only brown and weathered the following spring but the forage within was a bright green colour. Kudzu can be cut readily with a mower. The first mowing may prove difficult and an old scythe blade fastened vertically to the end of the cutter bar is advised.

The reports of experimental work in South Africa are given, but this is not extensive, and further trials are in process and the results will be reported later.

157 - **The Castor-Oil Plant of Cyrenaica.** — SCAETTA, H., in *L'Italia Agricola*, Year LVII, No. 11. pp. 331-333 + 1 fig. Piacenza, Nov., 15, 1920.

In Cyrenaica, the wild castor plant frequently grows as large as a tree, that is, to a height of about 5-6 metres. The only varieties which seem to exist there are *Ricinus communis minor*, *R. sanguineus*, and *R. viridis*. The first grows in mellow land which is not extremely arid. The second variety has been seen by the author on the Fetejah plateau, growing under perfectly arid conditions, in rocky soil and in the valleys of certain ouadi.

The plant is normally monoecious; the same inflorescence carries male flowers at the base and female flowers at the tip. The male flowers sometimes grow around a single female flower.

The average length of the inflorescence is 25 cm. The fruits are dehiscent in var. *minor* and indehiscent in the var. *sanguineus*. The appearance of the plant is characteristic. In the oases, near the small irrigation canals, it grows so rapidly that in 2 years it is as big as a tree, with large, light-green leaves with long petioles, and branches with elongated internodes. In dry soil, however, whilst still retaining the tree-like aspect, the leaves are smaller and thinner and the internodes are shorter.

R. sanguineus, as observed on the arid, compact soil of the plateau has a low habit, is branched near the base, and has a red stem, and leaves, and inflorescences covered with fruit, whose red berries are speckled with brown, about 15 mm. long, 8 mm. wide, and 5-7 mm. in thickness.

Although the *minor* variety is generally cultivated, and yields more abundant and finer oil, it is, however, of secondary importance to Cyrenaica as it can only grow in cool soil or with the help of irrigation, i. e. on very limited areas. On the contrary, *R. sanguineus* manifests, in Cyrenaica, a great resistance to drought and winds; it seems as if the heat of summer and the aridity of the ghibli facilitate the maturation and dehiscence of the fruit. Even during experiments made in Algeria and Senegal this plant resisted heat and drought. The castor-oil plant is not cultivated by the natives. In 1920, experiments were commenced in Cyrenaica with *R. sanguineus*, without irrigation.

158 - ***Saccharum spontaneum*** (1). — RIVIÈRE, C., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 38, pp. 912-916. Paris, Dec. 15, 1920.

Saccharum spontaneum L. = *S. aegyptiacum* Wild = *S. biflorum* Forskal is a plant that grows to a height of between 2-3 metres, sometimes more, and has perennial, abundant foliage. Found wild in many parts of the world, it is spreading in the eastern basin of the Mediterranean. However it is found in small and rare patches in the neighbourhood of Bône, Algeria.

This strong perennial plant, bushy and spreading is easily propagated and is chiefly used for fixing sand-dunes either on the sea-shore or in the desert, but where the temperature falls but slightly below zero.

It is now 50 years since the author introduced, cultivated and wrote about this plant in the Experimental Garden, at Algiers. Although growing wild on the dunes, this *Saccharum* does quite well in compact soils, but prefers light soils with a damp substrate. The regions most favourable to its growth are the shore and low marine climates, then the low deserts, for the High Plateaux do not suit it as the temperature falls below zero.

The cultivation of this species is extremely easy. Propagation is effected by simple division or splitting of the rhizome 25-30 cm. long, leaving one or two pieces of stem; it is then planted in a shallow furrow. The spacing of the lines and plants can be varied at wish, but the spreading tendency of the roots of this species must be remembered. The plant strikes quickly and resists prolonged drought, but irrigation or watering will encourage a much more rapid growth

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(1) See *R.*, June, 1920, No. 652. (*Ed.*)

Two economical methods are now adopted:—

(1) The *Saccharum*, although rhizomatous, is, on account of its dense growth, an excellent plant for improving low and marshy land, for it soon covers it and dries it up; it can also be planted along water-courses, for it protects the banks against erosion as it does the dunes.

(2) In damp or watered soil, this plant, especially the young shoots, makes a fodder, that is appreciated by cattle, camels and asses, which are usually easy to please as regards food in certain seasons. If the plant has grown too much and has become leathery, with sharp leaves, it should be made into silage. If aided by watering an abundant yield can be obtained by successive cuttings.

The utility of this plant is great, as the stems, 3 metres high, can be cut twice a year and used to make fences, wind-screens, roofs, furniture, packing, etc. But the plant should not be cultivated as a wind-screen, for not only will it spread into the crops, but it harbours a very harmful insect.

This *Saccharum*, like sorghum, sugar-cane, maize, and other big gramineae, is subject to attack by a very prolific lepidopteron, *Sesamia nonagrioides* Lefèvre, which leaves it in the larval stage and spreads into and ravages all the food crops, especially herbaceous ones. It is also unwise to plant this species around vineyards because the vines will be exposed to attacks from *Sesamia nonagrioides* which are more active and more to be feared than those of the " altise ".

The insects, which emerge from the dry stems of the *Saccharum* when used as coverings of fences against the sun or wind will rapidly destroy market-garden crops and even damage extremely rare horticultural specimens.

159 - **Low Temperatures in Floriculture.** — MARINO, A., in the *Rivista del Freddo*, Year VI, No 8, pp 277-278 Rome, Aug., 1920.

From the floricultural point of view the chief points of interest for the refrigerating industry are:— 1) To be able to retard the growth and, consequently, the flowering of plants; 2) to be able to preserve the flower as long as possible.

The following facts have been deduced from practical observations:—

The lily-of-the-valley flowers quickly, and arrives at maturity about 3 weeks after being taken from the refrigerator. Spiraea matures in 6 or 7 weeks, *Azalea mollis* Bl. (*Rhododendron molle* G. Don) in 5 or 6 weeks. The different species of *Lilium* (*longifolium*, *auratum*, and *tenuifolium*) flower, the first after 13-15 weeks, the second after 16-18 weeks, the third after 18-20 weeks. *Lilium longifolium*, potted in the summer, flowers in 16-18 weeks. Usually, lily bulbs potted after the middle of September flower, 1, 2, or 3 weeks after, according to the time of potting, but this should not be later than the second week in November.

The temperatures to which the young plants can be subjected vary.

Lilium candidum bulbs will stand −2.2° C., those of *Lilium longiflorum* must be kept at a constant temperature which should not exceed 15°C., and when they bear shoots the temperature should be raised to 18°C. in the greenhouse and 21°C. in the sun. *L. auratum* bulbs can be kept in drained pots with dry earth at 13°C. until they sprout, then at 20°C., until they flower.

The lilac and lily-of-the-valley (rhizomes and young plants) should be kept at a minimum temperature of −8°C. and at a maximum of −5°C. Rose trees can be kept from November to March at 6-10°C.; they can thus be kept from the frosts and all growth is stopped until spring is well advanced.

Dutch hyacinth bulbs are kept at 0.5°C. The hygrometric degree at which bulbs, rhizomes and young plants are usually kept is from 80-90 %. In the case of cut flowers the facts are as follows:—

Astrea keeps well for 35 days, at a hygrometric degree of 85 %. Chrysanthemums 45 days, with 90 % or more humidity.

The iris is difficult to keep, and resists at most for 12 days at 2°C. with 85 % of relative humidity.

The hyacinth keeps well for more than a month at 2°C. and 85 % relative humidity:

White lilac keeps better than the coloured varieties: about 30 days.

Lilies (especially *L. candidum*) when not quite open, keep 30 days at 2°C. with 80 % hygrometric degree. Narcissi, violets and tulips keep more than a month, better as buds or slightly closed, at 3° C. and 85 % relative humidity.

The rose shews little resistance to cold, but buds will keep 8 days at 2° C. and 85-90 % relative humidity.

The flowers for conservation should be plucked on days that are neither too hot nor too dry, and put into the refrigerator immediately.

160 - **Edible Fruit of the Madagascar Katoka Tree (*Treculia* sp.).** — JUMELLE, H., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 19, pp. 924-926. Paris, Nov., 1920.

The commercial interest which, in 1920 was taken in the "katoka" fruit imported from Western Madagascar has led the author to study the botanical origin of this fruit. The type cultivated is an artocarpus, which the author considers as new, belonging to the genus *Treculia* He has named it *T. Perrieri* and it is related to the jaca and bread-fruit.

The katoka, called "Tabory" or "Stipa" by the Sakalaves, is a tree which grows to a height of 30 metres; the trunk, deeply furrowed, has a smooth and greyish bark. The leaves are persistent. It flowers in October, and the fruits ripen in January and February.

Treculia is generally considered to be dioeceous.

M. P. DE LA BATHIE admits, however, that the katoka may also be monoeceous. Usually the male thalami are on the young branches and the female receptacles on the older branches. When mature the female thalamus becomes a sessile syncarpium or false fruit, fairly irregular in form, like the jaca. It attains more than 30 cm. in diameter and weighs up to, and over, 5 kg. It is fleshy and contains, near the surface, 6 or 7 layers of oval achenes, the size of small nuts.

T. Perrieri is common in the west of Madagascar in damp woods, below an altitude of 300 metres, on the alluvia of all the rivers from the extreme north to south. It appears to be lacking in Samberano only. The white wood is very good, and is used locally for making spoons and other small household utensils.

The fruit is usually said to be an oil-seed and has been sold as such in Marseilles, but it is really more starchy than oil-bearing. They are edible, with a good taste, and are eaten by the Madagascans. The yield of this tree is about equal to that of the jaca tree.

161 – **Plant Propagation and Fruit Culture in the Tropics.** — WESTER, P. J., in *Bulletin No. 32, Government of the Philippine Islands, Department of Agriculture and Natural Resources, Bureau of Agriculture*, pp. 9-134 Pl. XXIII + figs. 53. Manila, 1920.

Details are given of plant and propagation sheds, nursery accessories, the principles and various methods of propagation by seed, cuttings, layering, grafting and budding, and directions for the vegetative propagation of tropical and semi-tropical plants, and also for tree planting and orchard management. The methods of selecting shade trees and ornamental plants are given, followed by preliminary remarks as to plant pests and diseases injurious to orchard trees etc., and the methods of spraying recommended. Formulas for fungicides, and insecticides are described.

A list is given of tropical fruits, spices and beverage plants in the Philippines, and Tables show the number of plants, set at given distances, required for 1 hectare and the general spacing according to the type of plant etc. Tables of common measures employed are also added.

The author has issued this publication in the hope that it will serve to popularise better methods of propagation, particularly asexual methods, and better methods of cultivation of superior varieties of tropical fruits

162 – **Selection of Stocks in Citrus Propagation.** — WEBBER H. J., in *Bulletin No. 317, College of Agriculture, Agricultural Experiment Station, Berkeley, California*, pp. 269-301, Figs 14. Berkeley, Jan., 1920.

The older methods of budding stock of different types and unknown character of growth are believed to be largely responsible for the different sizes of budded trees developed in the nursery, and also for many of the irregularities in size and fruitfulness of orchard trees. The author made comparative tests wich large, intermediate and small nursery trees, and emphasises the fact that although every care was taken at every step to reduce the amount of variation through using good sized stocks and buds from highly selected trees, nevertheless, when the buds were 2 years old and ready to transplant into the grove, they showed considerable variation in size. The great influence that the stock may cause on the scion is well illustrated by the growth of the Eureka lemon on trifoliate orange stocks as shown by trees grown at the Citrus Experiment Station.

At 13 years of age the buds on the latter stocks of which there were about 15, were not more than 1/5 the size of those on sweet, sour or grapefruit stock.

Some evidence may be drawn from the fact that the Chinese lemon and the Florida rough lemon which differ from each other much in the same way as the different types of sour orange, showed that the former proved a poor stock while the latter gave excellent results

From the results obtained in the authors' experiments the following recommendations are made: 1) the importance of growing and fruiting buds from the types and sizes which make up the composite mixture grown at present as sweet and sour orange stocks etc., 2) the severe culling of the seedlings at the time of transplanting from the seed bed the seed bed; 3) buds should never be inserted on inferior small stock. The larger nursery trees in the experiments described continued to show their decided superiority over the intermediate and small trees 4 1/2 years after budding and 2 1/2 after transplantation, 4) under sized buds should be cut out when the budded trees have reached the age for transplanting into the orchard. The number of trees which may have to be discarded will depend on the variation present in the nursery.

The importance of discarding carefully is evidenced by the fact that even when the stocks had been selected with much more care than ordinarily as in these trial experiments and the buds taken from good trees of known record, yet about 15 % of the Washington navel trees were discarted and a somewhat smaller percentage of the Valencias and grape fruits.

163 – **Bud Variations as the Cause of Deterioration of Old Fruit-tree Varieties.** — See No 148 of this *Review*

164 – **Ripening of Pears: Changes Taking Place During the Stages of Development and the Temperature Effects on Composition.** — See No 217 of this *Review*.

165 – **The Direct Hybrid Bearer "4401 de Couderc" in Portugal.** — DUARTE D'OLIVEIRA, in the *Revue de Viticulture*, Year 27, No 1378, pp 350-351 Paris, Nov, 1920

Results obtained in Portugal with the new direct hybrid bearer, 4401 de Couderc, which has taken some time to propagate. It was only in 1918 that a plantation of 2 or 3 branched cordons could be made.

Although the plantation is still so young, (in the second year), and in consequence the grapes are not very large, it has been possible to observe that the productivity of the vine is excellent and that it is absolutely resistent to mildew. The glucometric degree, acidity, and yield have still to be considered, all facts of great importance as regards a new vine This has been done by the author in comparison with *Pinot Noir* and *Cabernet Sauvignon* (French) and *Douzellinho do Castello* and *Alvarelhão* (Portugese). The following results were obtained:—

	Density et 15° C	Sugar por litre	Alcohol	Total acidity as Tartaric acid	Yield in juice per kg. in cc.
Pinot noir	1109	260	15.3	9.0	500
Cabernet Sauvignon . .	1084	194	11.0	8.3	542
Donzellinho do Castillo.	1107	255	15.0	11.0	540
Alvarelhão.	1077	175	10.3	12.0	702
4401 de Couderc . . .	1110	263	15.5	8 5	620

166 - **British Empire Forestry Conference.** — *Quarterly Journal of Forestry*, Vol. XIV, No. 4, pp 265-294 London, Oct, 1920.

The British Empire Forestry Conference, consisting of the delegates from the British Empire, assembled in London on July 12-21, 1920. After deliberation and discussion certain resolutions were passed which will be brought to the notice of the respective Governments. These may be summarized as follows.

I. *Forest Policy.* — In view of the great importance to the Empire as a whole, as well as to each of its component parts, of producing a sustained yield of all classes of timber, and of encouraging the most economical utilisation of timber and other forest products, and of maintaining and improving climatic conditions in the interests of agriculture and water supply, each of the Governments of the Empire should lay down a definite forest policy to be administered by a properly constituted and adequate forest service.

II. *Survey of Resources.* — The foundation of a stable forest policy for the Empire and for its component parts must be the collection, coordination and dissemination of facts as to the existing state of the forests and the current and prospective demands on them. (A note is appended descriptive of the Survey desired).

III. *Constitution and Status.* — In order to attain continuity in the development of forest resources it is desirable that certain elements of stability be secured in the constitution of the forest policy. This may be done by the following measures :

(1) The definition, where this has not been done already, of forest policy in a Forestry Act or Ordinance.

(2) The reservation, for the purpose of economic management and development of forest land, under conditions which prevent the alienation of any which is primarily suitable for forests, except for reasons consistent with the maintenance of the forest policy as a whole.

(3) The assurance to the Forest Authority of funds sufficient to carry out the accepted, policy for a series of years.

(4) The grant to members of the forestry service of the status of Civil Servants with due provision for pension.

(5) The appointment as the chief officers of the forestry service of persons having a high standard of training in forestry, their selection and promotion being by merit alone.

(6) The establishment in each of the larger parts of the Empire, and for the Colonies not possessing responsible government collectively, of an officer, or officers, having special duties of advising as to forest policy, and surveying its execution

IV. *Organisation of Forest Industries.* — Its is extremely desirable that the Forest Authority should be in close touch and consultation with organisations representing the interests concerned in the extraction and utilisation of timber and other forest products.

V. *Publicity.* — It is the duty of the Forest Authority in every part of the Empire to adopt and encourage methods of education and publicity in order that the people may be fully informed of the aims and purposes of forest policy and may thus be induced to co-operate towards its successful fulfilment.

VI. *Distribution of Forest Plants.* — The Conference have had brought to their attention the advantages which have accrued in several parts of the Empire from the wide distribution of forest plants, and desire to bring the method of encouraging tree-planting by distribution of plants either from Government or private nurseries gratuitously or at cost price to the earnest attention of their Governments.

VII. *Terminology and Trade Nomenclature.* — The following questions should be referred to the proposed Imperial Forestry Bureau immediately on its formation :— i) Standardisation of forest terminology ; ii) Correct identification of timbers, and standardisation of their trade names.

VIII. *Research.* — The scheme of research work is set out in a report from a Committee appointed to prepare a draft scheme for the organisation of that research work which is essential to the progress of forestry including both the production and utilisation of forest produce, the Committee to pay particular regard to the importance of avoiding overlapping and of co-operation with existing institutions. The report deals with the organisation and sub-division of research, with the relation of the different parts of research to one another and to education and practice, and with the subjects of research both generally and in relation to the needs of the different parts of the Empire. The report received the approval of the Conference and was recommended to their Governments for early consideration and approval.

IX. *Education.* — It should be a primary duty of Forest Authorities throughout the Empire to establish systematic schemes of forestry education. It has been found for climatic and other reasons that it would not be possible for each part of the Empire to establish a complete scheme of forestry education of its own, and therefore it is essential that those parts of the Empire which are willing and able to establish complete systems should, as far a possible, frame such schemes with a view to combining for meeting the needs of those parts which can themselves only make a partial provision for their requirements. Part of this subject has been dealt with by a committee, whose report, which refers mainly to the higher training of forest officers is approved by the Conference. The main principles embodied in this report are as follows :—

1) That one institution for training forest officers be established in the United Kingdom

2) That students be selected from graduates having taken honours in pure or natural science at any recognised University.

3) That it be an integral part of the work of the institution to arrange supplementary courses at suitable centres for students requiring special qualifications and also special courses for forest officers from any part of the Empire, whether at the institution itself or at centres of training in other parts of the world. The Governments should recognise these courses as part of the ordinary duties of the forest officer, at any time during their service, and the Governments concerned should give special facilities to forest officers in their service to attend such courses.

4) That a Department of Research into the formation, tending and protection of forests be associated with the training institution.

5) Encouragement should be given to the existing provision made by Universities and Colleges for forestry instruction for those who do not desire to take the full course suggested for the forestry service. It appears that this is especially applicable to the United Kingdom.

It is also desirable to make adequate provision for woodmen's schools for the training of foresters as distinct from those which are intended for forest officers.

X. *Forestry Bureau.* — The Conference approve the suggestions and recommendations for the constitution of an Imperial Forestry Bureau, and strongly urge upon their respective Governments that they should contribute to the support of the Bureau as therein suggested. They feel that it will be largely upon the work of such a Bureau that the proper development of the forestry resources of the Empire will depend and they therefore cannot over-emphasise its importance as a part of Empire organisation. The objets of the Bureau are defined as follows:—

1) To collect, co-ordinate and disseminate information as to — (*a*) Forest education, research, policy and administration; the constitution, organization, and management of forests; and matters arising out of or incidental to the growing of timber and other forest products; (*b*) The resources, utilisation, consumption and requirements of timber and other forest products.

2) To ascertain the scope of existing agencies with a view to avoiding unnecessary overlapping.

3) To devise means whereby existing agencies can, if necessary, be assisted and improved in the accomplishment of their respective tasks.

4) To supplement these agencies, if necessary, in order to obtain any information not now collected which may be required for the purposes of the Bureau.

5) To advise on the development of the forest resources of the Empire or of particular parts thereof, in order that such resources may be made available for the purposes of Imperial defence or of industry or of commerce (1).

XI. *Future Conferences.* — The Conference is convinced that the holding of Conference of Representatives of the Empire on forestry matters is of great service. They recommend that the next Conference be held in the year 1923 and that, if the Dominion Government approves, it be convened in Canada.

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(1) See *R* 1919, No. 1076 (*Ed.*)

167 – **The Forest Resources of Spanish Morocco.** — *Iberica*, Year VI, No. 292, p. 131. Tortosa, 1919.

The eastern part of Morocco which is under Spanish influence is totally lacking in vegetation. The forest products are limited to firewood furnished by the brushwood which covers part of the mountains, especially those of the Quebdana chain, and Mounts Ameyer, Ziata, etc., and also to esparto (*Stipa tenacissima*), a textile plant which grows over 85 000 hectares of the mountains down to their lowest spurs, and which is now exploited. No true woods exist in the known part of the central region, where fuel is regularly obtained from the brush which grows at Cudia Taifor, on Mount Dersa and its spurs covered with lenticus, heather, and arbutus.

The "gabas" of Larache, Bu-Xaren, and Sahel in the western region can fairly be called woods. In the region of Alcazar there are scattered and unimportant groups of trees. The dominant species is the cork-oak, mingled with small olive, wild pear and oak trees. At Larache the gaba extends over 3 000 hectares, about half of which is covered by the cork oak; that at Bu-Xaren covers about 1500 hectares, moreo r less mingled with the cork oak.

That at Sahel covers about 7000 hectares, mingled with stands of oak and arbutus. This last area includes several villages and a great number of fields. In the gaba of Larache nearly all the cork-oaks have been stripped, the beneficial effect of which was observed from the beginning. In the gaba of Sahel parcelling out has been finished and the clearing of the brush and pruning of the cork-oaks is in hand.

The gaba of Bu-Xaren is not utilised to such an extent as that of Larache to which it is joined, the whole making a forest 6000 hectares in extent. The gathering of fuel wood from these gabas is practised tairy regularly, a revenue of about 13 000 pesetas per annum being obtained.

168 – **The True Mahoganies.** — Rolfe, R. H., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 4, pp. 201-207. London, 1919.

Of late years extensive planting of Mahogany trees has taken place in Trinidad and some other British colonies, and numerous specimens and fruits have been received at Kew with the enquiry as to whether they represent the true plant. Mahogany has long been known as the timber of a tree called botanically *Swietenia Mahagoni* Jacq., usually said to be a native of the West Indies and the adjacent coasts of Central America, but the term has also been extended to other red-brown timbers possessing somewhat similar properties, some of them belonging to other genera of Meliaceae and some to quite different families. The term, however, was originally applied to the West Indian tree, the timber of which has been known for upwards of 300 years, and under the name of Spanish mahogany, early became famous for the construction of articles of furniture.

At a somewhat later date British Honduras became famous as a source of mahogany, which until 1886 was generally regarded as the timber of *Swietenia Mahagoni*. In that year, however, Sir George King described and figured a new species under the name of *Swietenia macrophylla,* this having been grown in the Royal Botanic Gardens, Calcutta, from seeds collected in Honduras. Since then it has been generally recognised that Honduras mahogany is specifically different from the West Indian tree. There is also a third species, *S. humilis,* Tucc., a native of Western Mexico, which was thought to be in cultivation at Calcutta. Specimens of the Calcutta tree, however, including fruits, have recently been received at Kew, and prove to be a form of *S. Mahagoni,* Jacq. Further species formerly referred to *Swietenia* have now been transferred to other genera.

The present paper is limited to a description of the species of *Swietenia* proper, to which the true mahoganies belong.

169 - **Observations on the Planting of the Quicker Growing Conifers.** — Stewart, H. S., in *Transactions of the Royal Scottish Agricultural Society,* Vol. XXXIV, Pt. 2, pp. 141-145. Edinburgh, Nov. 1920.

The huge increase in the cost of plants and of labour, impels attention to the question of spacing, and the importance of ascertaining the best arrangement for various species of conifers in order to obtain the best silvicultural results at the earliest economic period.

The author carefully watched the effects of close planting on Japanese larch and Douglas Fir on a very favourable greensand soil and drew the following conclusions. Even the closest planting, at 3 feet, does not prevent, and only partially restrains branch growth, and if clean boles are required, hand pruning close to the stem must be utilized. The inadequacy of natural cleaning was evidently proved in two cases described.

Taking into consideration the question of root room, to obtain the greatest possible amount of cubic feet of such timber over a given area within a period of 15 to 18 years, which is the time required before these species acquire marketable value, the following scale of planting distances is advocated: —

For sitka spruce (pure) 5 ½ feet; for Japanese larch (pure) 6 feet; for Douglas fir (pure) 7 feet. The number of plants required per acre (square planting) respectively is 1440, 1210 and 889.

The author admits that this method of spacing will involve a certain amount of branch shortening in the earlier years etc., but the expense of these operations will not approach the cost of the initial planting of much greater quantities of young plants per acre. It seems clear that what may be reasonably close for ordinary conifers is unreasonably and even disastrously close for the quicker growing kinds.

170 - **The Establishment of a Douglas Fir (*Pseudotsuga taxifolia*) Forest.** — Hofmann, J. V. (U. S Forest Service), in *Ecology* (1), Vol. 1, No. 1. pp. 49-53, figs 1. Brooklyn, N. Y., Jan., 1920.

The varied combination of characteristics give the Douglas Fir (*Pseudotsuga taxifolia*) a wide range of adaptation, and a resultant superiority over its associates. The measurable characteristics which give it such a prominent place in a formation where the red cedar (*Thuja plicata*) and the western hemlock (*Tsuga heterophylla*) comprise the climax forest may be briefly stated thus:— The production of heavy crops of seed which is an evident advantage as this seed is a favorite food of the indigenous rodents. The surplus produced over the amount consumed by rodents is large and is stored away by them in the débris and mineral soil beneath the trees in " caches " varying in size from a few seeds to bushels of cones. But before the following spring all traces of the rodents' work have been eliminated by the snow and rain. The seeds are thus preserved in their natural storage of cool temperature and moisture conditions which reduce the oxygen content of the soil. Experimental evidence has proved the seed to be viable after 6 years storage in this manner, but it may lie a longer period of indefinite length. When the forest is removed by fire or by cutting, the stored seed is left under favourable germination conditions and immediately responds to the stimuli. The same holds true of the Western White Pine, (*Pinus monticola*). With the Douglas Fir, the early and quick germination of the seed under favourable conditions and the rapid development of a long radicle so pronounced compared with hemlock and cedar, enables it to become established where the others fail.

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(1) *Foreword.* — This Journal is issued to meet the demand for the collective publication of articles on ecology. Its pages are open to all who have material of ecological interest from whatever field of biology. While the variety of fields may cause diversity of treatment,

The unfavourable factors are the inability to withstand shade,which results in a reduced possibility in reproduction under a forest canopy. This is the underlying factor which makes the Douglas Fir a one generation tree in a natural cycle of this formation, and results in a consequent elimination from the climax forest.

These observations were made in the Pacific North west region of America with a view to pointing out that the above-mentioned factors are within the control of man, and it is on them that the scientific management of Douglas Fir must be based in order to keep the said region under continuous natural production of this most important species.

171 - **Mechanical Timber-Felling.** — GERDIL, H. (Inspecteur des Eaux et Forets), in the *Bulletin officiel de la Direction des Recherches scientifiques et Industrielles et des Inventions* reproduced in *Le Bois*, Year 30, Nos. 28 and 29. Paris, Dec. 9 and 16, 1920.

Timber-felling by hand is now a very costly and slow process, owing to the high cost of manual labour. This article supplies the latest information regarding the mechanical felling of timber in France, a problem which assumed great importance during the war.

Each successive operation, clearing, cutting both small and large wood, trimming, and logging, requires, according to the author, a special machine.

Trials of felling with red-hot wires have been discontinued in prac-

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yet the ecological significance of the papers will make them of general interest. Specialisation is inevitable, but makes more urgent the need for co-operation. To approach different subjects from similar points of view is to lay the foundations of co-operation.

tice, not only becase this method of carbonisation is too slow but there is too great a risk of killing the stumps and so ruining the coppices. The patent process of H. GANTKE, whereby a moving red-hot steel wire is employed was also tried, but the author thinks that the best way is to use a cutting tool.

The author briefly describes the instruments which were tested and found satisfactory; these were the alternating saw, circular saw, endless band-saw, mechanical axe or chisel, the wire or chain friction saw, the multiboring machine.

The problem of clearing has been solved by small locomobile saws several types of which are described by the author.

Credit must be given to the Americans who have produced a single machine which will carry out the whole work, with the help of a single workman.

172 – **The Use of Tanks in Sylviculture.** — HICKEL, R, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No 38, p. 905. Paris, Dec., 15, 1920.

M. Laurent RAYBAUD, preparateur de botanique à la Faculté des Sciences de Marseille, has suggested the use of tanks in the forests as fire-fighters, in re-afforestation, and for maintaining the fire-trenches.

In this last capacity, two tanks will be used, one on each side of the trench, dragging a harrow which will pull up all the weeds and throw them into the bottom of the trench, where they will afterwards be set on fire by flame-throwers provided with the tanks. The tanks will also carry a water tank, so that the upper edges of the trenches can be watered if there is any risk of the fire spreading in the forest.

LIVESTOCK AND BREEDING

173 – **The Persistence or Disappearance of the Virulence of Aphthic Milk During the Manipulations Subsequent to Milking.** — LEBAILLY, C., in the *Comptes rendus de de l'Académie des Sciences*, Vol. 171, No. 21, p. 1029. Paris, November, 22, 1920.

The author has shown (1) that the virulent nature of the milk is one of the earliest symptoms of aphthic fever, and that if given to young animals (calves and pigs) it causes their death from an acute form of the disease. On many farms, this mortality among the young stock has amounted to 100 %.

Certain breeders drew the author's attention to the fact that, formerly, on the same farms, epidemics of aphthic fever did not result in so many victims, and they were inclined to think that some other cause of contagion was at work. In the course of his enquiries, the author recognised the truth of this remark, and he believes, that he has discovered why formerly, cases of rapid death were much less frequent.

Now-a-days, the skim milk is given to the animals as soon as it leaves the separators, whereas, until recently, it was collected after the cream had risen, which is always attended by the beginning of lactic fermentation. Under these conditions, the aphthic virus, which is very easily affected, becomes greatly attenuated, if not completely destroyed. The course of the present out-break is being carefully watched, so that the epidemic affords all the advantages of a large-scale experiment. On small farms, where mechanical separators have not been introduced, the young stock fed on milk in which lactic fermentation had commenced, were either immune throughout the epidemic, or contracted the disease in a mild form. The centralisation of the milk in large dairies, and the division of the skim milk, has had the opposite result, and led to the rapid spread of aphthic fever. This consequence could not be foreseen, as it was not known that the milk of apparently healthy animals which are in the incubation period of aphthic fever, is a source of infection.

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(1) See *R*, Oct., 1920, No. 1002. (*Ed.*)

174 - **The Dipping of Sheep in So-Called Carbolic Dips.** — STEAD, A (Research Chemist, Grootfontein School of Agriculture, Middleburg. Cape), in the *Journal of the Department of Agriculture, Union of South Africa*, Vol. I, No. 6, pp 536-547. Pretoria, September, 1920.

The object of this paper is to warn both sheep farmers and dip proprietors that, while these so called dips are safe with some waters, they are unsafe with others. The most dangerous water appears to be of the moderately hard type, becase the oily globules separated under these conditions are very small and easily overlooked.

Investigations were carried out with three different coal tar dips. In the first case, (mixture and water in the proportion 1 : 50), of the first lot of 12 dipped, 6 died; of the second lot of 21 dipped, 5 died; of the third lot of 35 dipped, none died. Examination of the dip showed that it did not contain arsenic, that true phenol was practically absent, but that it contained higher phenols, pyridine, hydrocarbons, soda and water. It was not found possible to obtain a true emulsion by mixing with either fountain or distilled water; but distilled water mixtures contained very much less separated oils than the fountain water mixtures. The most perfect emulsion was obtained by boiling the distilled water before mixing, the explanation being that boiling expelled dissolved carbon dioxide from the water. A slightly improved emulsion was obtained with fountain water by placing it in a vacuum chamber (to remove carbon-dioxide) before mixing. An equally good result was obtained as that made with unboiled distilled water, by softening the water with soap prior to mixing, and also by partially softening the water prior to use by boiling.

The author's conclusion is that the first sheep dipped took with them out of the tank, not a chill, as was suggested, but separated oils.; that they were, in effect, dipped in too strong solution. The fact that all the sheep were not affected in a similar way may be attributed to the fact that the separation of oils was not found to be an instantaneous process and that some sheep were more resistant than others.

In the second and third cases, the results of the dipping were of a similar nature to the first, and bear out this point.

Recommendations. — 1) To free the dip wash of its separated oils by drawing absorbent material through it; 2) To soften the water before using, or by adding more soap to the concentrated dip; 3) To use small tanks; 4) To wash the animals well with a solution of Epsom salts and water; a hypodermic injection of a watery solution of Glauber salts is also advised.

The most reliable test, probably for the separation of dip oils, in doubtful cases, is to prepare some of the dip wash and pour it through a piece of blotting or filter paper folded to fit a funnel. Some at least of the separated oils should be retained by the paper. The risk that sometimes attends the dipping of sheep in these fluids has also been noted in America (1).

A note is added on the physiological action of carbolic acid by FOURIE (*Lecturer in Veterinary Science, Grootfontein School of Agriculture*).

175 - **Observation on the Body Temperature of Dry Cows.** — KRISS, M. (Institute of Animal Nutrition, Pennsylvania State College), in *Proceedings of the National Academy of Sciences of the United States of America*, Vol 6, No 8, pp 539-541. Washington, D C., Sept, 1920

An attempt was made to secure data regarding the extent and the course of the body temperature variations in cattle, and to study some of the factors that might influence them. The investigation covers a period of some 16 weeks. The animals were two dry cows used at the same time for metabolism experiments with the respiration calorimeter, in which strict control of feeding, environment etc. is maintained.

The observations on the thermal gradient were made at a depth of 4 to 7 inches, and all others at 7 inches depth. Results may be summarised as follows: 1) The rectal temperature was higher than the vaginal when measured at the same depth of 7 inches, showing, an average excess of about 3°F. The relative values, however, varied under different conditions, but showed a trend towards parallelism; 2) A fall in body temperature invariably followed the drinking of water, varying according to quantity drunk. After the effect of the water drunk in the morning had been overcome, the temperature remained fairly constant till about 2.30 p. m., otherwise it was practically constant the entire morning. From 2.30 until 5 p. m., there was a gradual rise in temperature; 4) Eating of feed raised the body temperature slightly for about half an hour when the cows received a maintenance ration; 5) A comparison between the temperatures taken at varying depths showed the unreliability of measurements at a depth of less than 6 inches; 6) The standing as compare with the lying position of the animal, had hardly any effect on the body temperature; 7) there was no difference in the temperature when measured before or after defecation; 8) daily fluctuations depend to a greater extent on the individuality of the cow; 9) a variation of 8°F in the rectal temperature of the same animal was observed, when measured at the same hour of the day under identical conditions and outside the influence of water or feed; while under the influence of water a difference of 1.3°F was observed at the same hour on two consecutive days.

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(1) See *R*, October 1917, No 925. (*Ed*)

176 – The Influence of Dry versus Fresh Green Plant Tissue on Metabolism. — I. Forbes, E. B., (Ohio Agricultural Experiment Station The influence of Fresh Food in Lactation, in *Science*, Vol. LII, No. 1350, pp 467-468, Nov., 12, 1920. — II. Robb, E. F. (University of Minnesota) Influence of Dry versus Fresh Green Plant Tissue on Calcium Metabolism, in *Science*, Vol. LII, No. 1352, pp. 510 New York, Nov., 26, 1920.

I. — A report of experiments with cows carried out in the department of Dairy Husbandry at the Ohio Experimental Station. Since 1911. a Group of Holstein-Fresian cows were maintained on dry feeds and silage alone. No green feed was allowed. Several of the animals now in the group were born in it, and had reached maturity entirely without green feed.

The said cows grew to normal weight, and produced and reared calves without marked or certain irregularity, or abnormality. The milk production was fair only, it being obvious that with normal treatment these cows would have given more milk. They were easily forced off feed and were noticeably in a less thrifty condition, as indicated by flesh and coats, than the balance of the herd, which went to pasture.

During the past summer, the author conducted palatability tests on these cows, with various mineral supplements, consisting of various calcium phosphate and carbonate preparations, fed alone or mixed with common salt. The cows showed a keen desire for such feeds, having eaten in several short periods, from approximately $^3/_4$ lb. to more than 1 ¼ lb. of mineral supplement per head per day. The avidity with which steamed bone was eaten, considered in connection with the discovery that negative calcium balances normally prevail during lactation in cows on dry feed, and the conclusion of Hart, Steenbock and Hoppert, that fresh grass favourably affects calcium retention, suggests that these dry-fed cows are in a state of mineral depletion, especially while giving milk. This suggestion appears therefore, to be a matter of practical importance in connection with milk production, but rations of dry feeds and silage though probably deficient in some constituent, are not entirely lacking in any essential.

II. — In order to make more exact studies of calcium metabolism on guinea pigs a group was fed with calcium free diets during and for 2 days before metabolism periods of 3 days in length. This made it possible to draw definite and reliable conclusions. The animals were under starvation conditions as regards calcium, but this lasted only 5 days, and examination of their bones did not show any difference compared with animals fed with liberal amounts of calcium. Animals that had been on diet of dried plants 14 days before the experiment, eliminated twice as much calcium as those fed on fresh green plants, and which during the experiment had received calcium-free orange juice. With animals that had been 21 days on a dry diet, the difference compared with the controls was more striking. Scurvy appeared in all the animals on the dry diet.

The author therefore points out that the antiscorbutic vitamine appears to be greatly reduced by drying (except in very acid foods *e. g.* fruits). The marrow tissue of the bones increases in proportion to the real bone and calcium is apparently lost from the bones in this way. This contradicts the idea presented by HART, STEENBOCK and HOPPERT, that the loss of calcium with dry feed is connected with rickets or an antirachitic vitamine.

177 - **Fodder Values for Milk Recording Societies and Dairy Herds.** — STEWART, D W, in *The Scottish Journal of Agriculture*, Vol 3, No 4, pp 433-438. Edinburgh Oct. 1920.

A report of the Scandinavian method of calculating fodder values. In Sweden an average sample of barley is taken as the standard, therefore if 1 lb. of average barley is taken as the fodder unit, then the unit of any other food will be that weight of it which will give the same result as 1 lb. of barley fed to a cow in a properly balanced ration. The milk producing value of 100 lb. of barley is 75 lb. The starch equivalent is 72 lb. Hence, if a unit is chosen for the fattening of cattle or the feeding of pigs instead of milch cows, the standard would be estimated on a similar basis to that described above.

A comparison between the average Scandinavian analyses and those made in Great Britain shows little difference. There is, however, a difference in the composition of homegrown fodders in Norway as compared with mid or southern Sweden; the former possessing a higher fodder value.

The cows in the byres are divided into two groups according to whether they are nearly dry or are low yielding, medium or high yielding. Rations are calculated for each group, and the individual animals receive the same amount of food daily. A cow moves from a higher to a lower group as her yield decreases. The rations are calculated as follows: —

Maintenance Ration. — For a 9 cwt., cow allow $6\,^2/_3$ units daily. For each 1 cwt. above (or below) 9 cwt., add (or subtract) .5 units. For each unit, allow .1 lb. of digestible proteid. These figures represent the bare maintenance requirements of dry barren cows: but in-calf cows are allowed 50 % above these quantities.

Production Ration, (in addition to above ration). — Allow 3.33 units for each 10 lb. of average milk (3.5 % fat), yielded daily. This applies to Ayrshire, Shorthorn or Holstein cows, but 3.86 units per 10 lb. milk should be allowed for Jersey and Guernsey cows. (4.5 % fat).

The cakes and meals mixture is worked out in the same way. It might consist of 3lb. barley bran, 3 lb. dried grains, 2 lb. sesame cake, and 2 lb. decorticated nut cake, or in that proportion. Of this mixture 1.02 lb. is a fodder unit, and this contains .207 lb. digestible proteid.

In the keeping of fodder records the allowance for pasture may appear to present a difficulty. If, however, cows are fed according to their live weights and milk yields this difficulty may be overcome.

The results obtained in 10 years successful work by one of the Scandinavian control unions, showed that in the tenth year 165.9 lb. of milk, or an equivalent 5.7 lb. of butter, was produced from 100 fodder units as compared with 120.8 or 4.13 for the first year, and 152.2 or 5.08 for the fifth year.

The feeding standards for other cattle are recorded as follows: —

Per Day per Head.

Young Dairy Cattle	Live Weight	Per Day per Head	
		Fodder Units	Digestible Proteid
	lb.		lb.
2–3 months	154	4 6	0.55
3–4 »	220	5 9	0 70
4–6 »	352	7 5	0 88
6–12 »	484	8.4	0 92
12–18 »	660	9 2	0 99
18–24 »	880	9 7	1 06
Over 24 »	090	9 9	1.09
Fattening cattle			
1–2 years	880	17.6	1.76
Adult	1 100	22.0	1.65
Cows	1 100	22.0	2.75

By means of fodder records of each cow it is possible to see which of them pay for their keep. It will be necessary to weight up the food used by each animal during a whole day about 20 times in the year. The food actually consumed on the control day represents the average consumption during the 10 preceding and the 10 following days. By multiplying the fodder of the control day by the days in the period, the amount of food used is thus estimated.

Marked progress has been made by the aforementioned control unions as the result of scientific breeding to get higher milk yields without lowering the proportion of fat in the milk.

A typical fodder table is given showing the average and variation to 1 fodder unit, and the digestible proteid per unit. The author states that his article is based on the publications of Prof. NILS HANSSON: — "*Handbok i Utfodringslära*" and "*Kontrollföreningarnas Arbetsfält*", published by C. E. FRITZE, Stockholm.

178 - **Lupins as a Livestock Feed.** — See No. 119 of this *Review*.

179 - **Press Cake of the Cohune Nut (*Attalea Cohune*).** — See No. 120 of this *Review*.

180 - **Crosses Between Ewe and He-Goat, Between Goat and Ram and Between Sow and Wild Boar in Sardinia.** — GALBI SERA, S., in *La Clinica veterinaria*, Year XLIII, Nos. 21-22, pp. 585-586. Milan, November, 15, 1920.

Crosses between the sheep and he-goat, and between the goat and ram were made in ancient times. The Romans gave the names of *tisiri* to the offspring of the first cross, and of *musmone* to that of the second.

Several stock breeders have tried to repeat these experiments, but without success, although the existence of such hybrids has been reported more than once (1).

The author has often observed the offspring of he-goat × sheep in Sardinia ; these animals in bulk, udders, and wool combine the characters of both parents. The female hybrids are preferred to sheep, on account of their larger milk yield. In order to obtain such crosses, it is necessary for the he-goat to have been brought up from a kid among the sheep. The hybrids are interfertile, but re-acquire the sheep characters.

In Gallura, the ram and goat are frequently mated ; the offspring resemble the goat in shape and coat, the only difference consisting in the size of the ears, which are shorter and wider than those of kids, and are carried like the ears of lambs.

Sow × wild-boar hybrids are very common, especially at the times when the herds of swine are sent into the oak-forest, where they lead a wild life. As a rule the offspring have a spotted coat, and show certain characters that do not belong to domestic animals.

Sometimes, the sow produces a litter composed half of young pigs and half of young wild boar, in which case, the latter separate from the former, and lead their own lives.

181 - **The Indices of the Mule.** — PORCHEREL, A., in *Revue vétérinaire*, Vol. LXXII, Third Series, Vol. 1, pp. 746-755. Toulouse, December, 1920.

The author has given the dimensions of the various parts of the mule's body and limbs (2); The ratios between some of these measurements give indices that, in certain cases, can supply information regarding the morphology of the animals.

I. TOTAL CEPHALIC INDEX (relation between the maximum width of the head and its length calculated as 100). This index varies between 38,3 and 43.3 in the mule, and between 35.7 and 56.09 in the ass. The lowest indices are usually found in the case of mules coming from America. The total cephalic index of the African donkey is larger than that of the Poitou donkey.

No conclusions can be drawn from this index as to the transmission of the cephalic characters of either donkey or horse.

The mule appears to be intermediate between these two animals ; very numerous variations, however occur, owing to the transmission of the hereditary characters of both horse and donkey which show themselves in the hybrids.

II. BODY INDEX (relation between scapular-ischial length and circumference of thorax, the latter calculated as 100). — In the case of the mule, the author obtained figures varying between 83 and 98, in that of the donkey between 80 and 93. There is no connection between the body index and the origin of the animals. In pack-mules, the best indices vary from 83 to 88, and indicate those that are most satisfactory for carrying loads.

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(1) See *R*, 1918, Nos 889 and 1140. (*Ed*)

(2) See *R.*, Oct 1920, No 1010. (*Ed*)

III. THORACIC INDEX (relation between the greatest width and the greatest depth of the chest). — In most mules, the chest is usually more elliptical and the ribs are less rounded than in the horse The author has observed variations between 83.6 and 90.5.

IV. INDEX OF COMPACTNESS (relation between the weight of the animal and the number of centimetres in height above one metre). — The figures obtained vary between 6.5 and 9.7.

In the case of pack-mules, this index should vary between 8.5 and 9.5, which shows a good proportion between the height and the weight of the animal.

V. DACTYLO-THORACIC INDEX (relation between the circumference of the cannon-bone and the perimeter of the thorax). — This in the mules measured by the author, varied between 0.096 and 0.121. The best measurement indicates that the circumference of the chest is 8 or 9 times that of the cannon-bone.

In addition to the height, the weight of the animal must be taken into account, as a limb cannot be pronounced stout or slender except in proportion to the weight of the body it is called upon to support. In order to determine which mules of equal weight had the strongest legs, the author found the circumference of the cannon-bone per 100 kg. of weight.

The lowest figure was given by a Corsican mule (3.75), the highest by a mule of American origin (5.31) ; the average was 4.44.

In the case of the donkey, he found an average weight of 177 kg., the average circumference of cannon-bone 0.143 m., and the circumference per 100 kg., 8.90 m.

There is thus no connection between the circumference of the cannon-bone, and the load the animal can carry

BARON's formula $95 \frac{C^2}{H} =$ load the animal can carry (C being the circumference of chest and H. the height at the withers), is therefore not always practically applicable. With this formula, too heavy a burden is obtained ; in the authors' opinion, it can be estimated more accurately at between $^1/_2$ and $^2/_5$ of the live weight. The figures thus obtained are lower, but in this case again, there is no connection between the volume of the cannon-bone and the theoretical load the animal can carry.

182 - **The Effect of Drugs on Milk and Fat Production** (1). — HAYS, F. A and THOMAS, M. G. (Delaware Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XIX. No 3, pp. 123-138, figs 8. Washington, D C., May 1, 1920.

The opinion that milk production and butterfat yield can be influenced by the use of drugs is widespread among dairymen. The objects of the author's experiments were: 1) To determine the effect of various drugs on the butter fat test of milking cows; 2) to study the effect on the total fat yield of producing cows: 3) to determine whether drugs have an effect on the health or on total milk production. The 4 cows of mature age selected for experimental purposes included one grade Holstein, one pure-bred Holstein, and two purebred Guernseys. The interval of experimentation with each drug was 5 days. The control and experimental periods alternated, and the order in which the drugs were given was so arranged that each cow received of the 8 drugs for a 5 day period. The cows were milked twice daily, the weight of milk recorded, and composite samples from each cow were tested for butterfat daily.

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(1) See *R.* July Sept. 1919, No. 946. (*Ed.*)

The following table gives a summary of the results obtained:

Drugs used	Average total milk			Fat test			Average total butter fat		
	Control	Treated	Gain or loss	Control	Treated	Gain or loss	Control	Treated	Gain or loss
	lb.	lb.	lb.	%	%	%	lb.	lb.	lb.
* Food Tonic No. 1.	92.2	93.7	+ 1.5	4.37	4.57	+ 0.20	3.998	4.285	+ 0.287
Air slaked lime . .	67.3	81.9	+ 14.6	5.21	5.00	— 0.21	3.509	4.095	+ 0.586
Fowler's solution of arsenic	107.3	109.0	+ 1.7	3.72	3.86	+ 0.14	3.995	4.210	+ 0.215
Gentian.	113.5	108.2	— 5.3	3.93	3.98	+ 0.05	4.459	4.302	— 0.157
* German tonic mixture	108.8	108.0	— 0.8	3.97	3.75	— 0.22	4.205	4.049	— 0.156
Physostigmine sulphate	108.7	99.9	— 8.8	3.89	3.60	— 0.29	4.226	3.706	— 0.520
Sodium bicarbonate	93.1	90.8	+ 2.3	4.43	4.43	+ 0.00	4.132	4.020	— 0.112
Ginger	92.5	93.8	+ 1.3	4.28	4.32	+ 0.04	3.968	4.055	+ 0.087

* Food Tonic — 100 lb, oil meal, 5 lb., saltpetre, 5 lb, Epsom salts, 5 lb., gentian, 5 lb., fenugrek, 8 lb., powdered charcoal, and 5 lb., sulphur.

** Tonic mixture — 3 oz., black sulphide of antimony, 1½ oz, sulphur, 5 oz., each of fennel, caraway and juniper berries, 1 lb. common salt.

A study of individual records and average records does not indicate that drugs have a very pronounced effect on the production of the dairy cow. Air-slaked lime, however, fed in 2 oz., doses daily, may possibly increase milk production and total fat yield, but no other drug or mixture tested proved to be of any marked value. Results do not indicate that the difference in character of milk of Holstein and Guernsey cows, has any relation to their manner of reaction to drugs.

183 – **Winter Feeds for Ewes.** — ARKELL, P., in *Farm and Dairy*, Vol. XXXIX, No. 49, p. 1322. Toronto, Ont., Dec. 9, 1920.

The best feeds recommended for breeding ewes are swede turnips or mangels, good clover hay (preferably alfalfa), oats and a little bran mixed. The author feeds hay in the morning followed by roots, and roots first at night. For 1 doz. ewes, ½ bus. of turnips, 1 bus. of cut hay, and 12 qts. of grain as a midday feed, and hay and roots at night, would be good feeding and the flock should give good results. It is advised to give plenty of water also. Male animals should never be fed on mangels, as disease invariably sets in.

184 – **Pig Feeding and the Cost of Pork Production.** — RUSTON, A. G. (Lecturer in Farm Economics, Leeds University), in *The Journal of the Ministry of Agriculture*, Vol XXVII, No 4, pp 340-349 London, July, 1920

The great reduction in the number of pigs kept from 1915 onwards, in England, can most probably be accounted for by the increasing difficulty in securing food supplies for them, and by the widely prevalent idea that the high prices of pig meal and miller's offals made the production of pork economically unsound. Now that feeding stuffs are more readily obtainable, and prices have fallen, it was thought by the author that the actual detailed records of the receipts and expenditure in connection with the management of pigs on a Yorkshire farm of just over 300 acres, 1918-1919, might be of interest. The Department of Agriculture of Leeds University has for some time past been engaged in investigations into the cost of production of milk, pork, beef, mutton, crops etc. on a number of farms throughout the country, including its own experimental farm. On these farms, detailed valuations of the live and dead stock are made at the beginning and end of each financial year.

On the farm in question, the accounts for 1918-19 show a net profit of £414.19*s* 5*d* ; on the total capital outlay of £1,173.0*s* 8*d* the percentage profit would therefore be 35 ½ %.

Although there was nothing very radically wrong with the method of feeding the pigs, it does not follow that the best or most economical method had been adopted. The average ration fed to the pigs during the year, adhered to the standards suggested by KELLNER fairly closely. The average live weight per pig on the farm, throughout the whole year would be approximately 150 lb. According to this, the daily ration actually contained:

26 lb of dry matter per 1000 lb live weight
4 lb of digestible protein per 1000 lb live weight
19 lb of digestible starch equivalent per 1000 lb live weight

If 4 acres of grass, at an approximate cost of £10, and the produce from 1 ½ acres of vetches, at approximately £12, had been placed at the disposal of the pigs, it is probable that a saving of at least 3 tons of meal at £20 per ton might have been effected.

The author gives details of the cost of labour, food, rent and rates in addition to the Profit and Loss sheet. The importance of increasing to as large an extent as possible, the production of cheap home grown foods, is emphasised, if pork is to be produced on the most economical basis, and the results in the farm described, show that the breeding and rearing of pigs can be done now on economically sound and certainly remunerative lines.

185 – **Report on the Fifth, Sixth, Seventh, and Eighth Victorian Egg-laying Competitions** (1) **1915-1919** — HART, A., (Chief Poultry Expert), in *The Journal of the Department of Agriculture of Victoria*, Vols. XIV to XVII, pp 6. Melbourne, June 1916-19.

The Egg laying competitions started in Victoria 1904-1905 at the Dookye Agricultural College. Then, six White Leghorns won the test with 1313 eggs for 12 months. In the test concluded at Burnley in 1916, the winning pen produced 1661 eggs, in 1917, 1503 eggs, in 1918, 1405 eggs for 11 months only and in 1919, 1511 eggs ditto. These results are with light breeds in the wet mash section. Each year the White Leghorns were very much in the majority in the light breed tests. Figures indicate similar comparative results with this breed in the dry mash section.

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(1) For fourth report of Competition, see *R.* Sept 1915, No. 915. (*Ed*)

With the heavy breeds, Black Orpington invariably took the leading place. Wet mash section :— 1915-16 total eggs = 1,507 ; 1916-17, 1409 (12 months) ; 1917-18, 1274 ; 1918-19, 1306 (11 months).

In Competition 7, the most interesting result was the Black Orpington hen which laid 307 eggs in 11 months. the highest result on record.

In Competition 8, no records were achieved, but the general results were satisfactory. The only other Light breeds besides White Leghorn taking part were Ancona, and Minorca, the first showing the best results. With heavy breeds other than Black Orpington, the Rhode Island Reds were the best, and showed superiority to the Silver Wyandottes and Buff Plymouth Rock, competitors in 1917-18.

The author gives details of the feeding and housing of poultry, and in the Journal 1919 suggest the advantage of a Co-operative Poultry Farmers Society to ensure success in the poultry industry and obviate difficulties in egg transport, etc.

186 – **A New Brazilian Breed of Fowl : The "Musica".** — DE CARVALHO, D , in *Chacaras e Quintaes*, Vol XXXII, No. 4, pp. 275-276 + 1 fig São Paulo, Oct., 15, 1920.

At Barra de Paraopeba (Western part of the State of Minas), there exists a breed of fowl which is distinguished by its peculilar crow, whence the local name of "Música" or "musicians" which according to the author, suits them but little. They appear to be a pure breed, which has been neglected and is now degenerate.

The plumage has always 2 colours : yellow tipped with black, or black more or less speckled with white. The hens are the same colour as the cock, but are less brilliant. Moreover, the dorsal region is very inclined and forms an acute angle with the tail. In both sexes the tarsi are a green that is almost black ; the small lobes are white and very regular ; on the crest is found a rudimentary tuft ; the crest is simple, evenly dentate and upright. The flesh is white and the skeleton slender.

The cock is the same size as the common hen but is of very different appearance. The tail is long, curved, and carried well, and gives him a very elegant appearance.

The author has undertaken the selection of this hardy and vigorous breed, because its characters are of practical value, neglecting however, the character from which it takes its name as it has no agricultural value.

187 – **Wintering Bees in Canada** (1). — SLADEN, F. W L. (Dominion Apiarist), in *Bulletin No. 43, Dominion of Canada, Department of Agriculture, Dominion Experimental Farms*, pp 3-12. Ottawa, 1920.

The author explains in detail the reasons why successful wintering depends chiefly on three conditions, namely ; the need of populous colonies consisting mainly of young bees, plenty of wholesome stores in the combs, and adequate protection from the cold.

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(1) See *R.* June 1918, No 670. *(Ed.)*

The two ways of protecting bees are compared, i. e. 1) out of doors in cases filled with packing material, and 2) in doors in the cellar. The first method is found preferable in comparatively mild districts, and the latter in colder areas.

I. — The best and most economical type of wintering cases is found to be one made to take four hives *en lloc* and usually back to back. This method encourages warmth., and uses less material per colony, in construction. The case should be at least large enough to allow 4 inches of packing between the hives, and the sides and bottom of the case, as well as a space of 8-10 inches between the hives and the cover to serve as a air chamber. The sides and floor of the case should be of grooved and tongued boards, and the roof should be of thin boards nailed to a strong frame in telescope form, and covered with roofing to make it waterproof. A collapsible case is found to be convenient.

The construction of the flight holes needs particular attention and they should be cut in the sides of the case opposite the hive entrance, but a least 1 foot apart, To meet both winter and spring conditions the author advises the cutting of the hole 4 to 5 inches wide by 1 inch high, and to have a close-fitting piece of wood revolving on a screw which will reduce it to 1 inch by $^3/_8$ inch, or $^3/_8$ by $^3/_8$ of an inch. There should be no projecting ledge beneath the winter entrance to lodge snow and ice.

In a cold region, it has been found advisable, in placing the hives in the case, to leave a board or oilcloth covering over the combs to prevent the escape of too much heat and moisture. By placing sticks underneath, a passage is made for the bees to pass over the combs, and should be at least $^5/_8$ inch deep to prevent the blocking of the hive entrance and flight holes with dead bees in winter.

The packing should be well air spaced, and the process carried out in September, preferably before the fall feeding is done, and the bees ought not to be removed from the cases until late spring.

Experiments covering seven years at Ottawa, have shown that colonies wintered outside in the 4-colony cases, began breeding earlier and averaged stronger by the end of May, than those wintered in the cellar, but careful preparations were essential to ensure success.

II. — For a good bee cellar, the temperature keeps steady between 45° and 50°*F*, the air is fairly dry, and not without ventilation, and light is excluded.

The cellar should therefore be low in the ground and thus very little affected by changes in the outside temperature, and the ground should be well drained.

As to the time to bring the bees into the cellar, the best time advised is as soon after the last good flight as possible. In many places this is early in November. The best date to bring them out is usually when the willows come into bloom, if the weather is favourable.

A brief survey is given as to spring management.

188 – **Japanese Bivoltines in Italy.** — ACQUA, C. (R. Scuola Superiore di Agricoltura in Portici), in *Informazioni seriche*, Year VII, No. 20, pp.301-303 Rome, Oct., 20, 1920

Numerous second rearings of Japanese bivoltine breeds imported 3 years previously were carried out in 1920 in various parts of Italy. From observations made by the author in many sericultural establishments, according to rearings made at the Higher Agricultural school at Portici, it can be said that, save for certain percentage of failures, which were always normal in all the rearings even in spring, the Japanese bivoltine breeds of silkworms, and especially the "Nipponshiki" breed, which was preferred to the others, have given very satisfactory results; they have proved very resistant to high summer temperatures, and the cocoons have given a very good yield on winding. These results were observed particularly in those localities where the seed was promptly distributed and had not to suffer during the period of embryonic development.

In the Osimo district (Province of Ancona) where 120 oz. was produced and distributed by a local establishment, there were only 3 or 4 failures, although the temperature frequently rose above 30 C°.

Crossing between female bivoltines and golden males also gave satisfactory results, but the resistance to great summer heat was slightly decreased.

According to the author, and contrary to the opinion of CAMPBELL (1), the problem of second rearings in Italy may be solved if the following precautions are taken.

1) Establishments that prepare summer and early-autumn grain should really use these breeds, and abandon the system of distributing the seed of common annual breeds, which have generally proved to be unsuited to these special rearings.

2) The preparation of bivoltine "seed" should be made according to rule this being especially important because of the frequent phenomenon of false bivoltinism.

3) The breeders should take the greatest care especially during the first stages when, because of the rapid drying up of the leaves during the great heat of summer the young worms which lie hidden under the leaves are easily lost. The breeder does not see them and consequently after rearing, he is astonished to find so few worms and consequently, so few cocoons, although there has been no disease.

In any case, it should not be expected that the yield obtained in summer is as great as in spring; the average weight of the cocoons produced per ounce is always much less in summer, and the consumption of leaves is also less

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(1) See *R.*, Nov-Dec, 1920, No 1166. *(Ed.)*

189 - **Cultivation of Eri Silkworms.** — JARDINE, N. K. (Inspector of Plant Pests and Diseases, Entomological), in *The Tropical Agriculturist*, Vol LV, No. 4, pp 247-249. Peradeniya, Ceylon, Oct, 1920.

The production of Eri silk (1) is more in favour in Ceylon than mulberry silk. The worm is fed on the leaves of the castor oil plant (*Ricinus communis*). When the worms are full fed and show signs of spinning, they are put into baskets containing dry leaves or shavings. Dry mango leaves have been found successful. After seven to ten days the cocoons are picked out and cleaned, and then placed in a tray.

The author advises the isolation of laying females in order that the egg masses may not become mixed, for it is of great importance that the silk rearer be assured that various egg masses are free from the pebrine disease which is transmitted to the egg.

After the moth has emerged the cocoon contains the chrysalis and cast off skin of the worm. An ingenious little machine was invested by CORYTON for LEFROY which turned the cocoons inside out rapidly and efficiently, and the debris thus was readily removed.

The following figures may be used as a guide to the producer: — 1 oz. of seed (eggs) should give approximately 112 lb. of green cocoons, which would dry down to about 36 lb. of clean dry cocoons — the products accepted by the silk spinners.

The following table gives the details approximately for 1 oz. of eggs (30.000 to 35.000 eggs) with regard to the quantity of food, and the space required: —

Stage	Days	Food in lb	Area in sq. ft.
1	5	4	1
2	4	12	9
3	6	40	30
4	7	112	100
5	10	700	200

FARM ENGINEERING.

190 - **The "Excelsior" Motor Plough.** — DESSAISAIX, R., in the *Journal d'Agriculture pratique*, Year 84, No. 52, pp. 514-515 + 1 fig. Paris, Dec., 23, 1920.

The "Excelsior" motor plough, made in Czecho-slovakia, and sold in France by M. A. RAVAUD (1, rue des Italiens, Paris) took part in the demonstrations held recently at Chartres (France). The 4 cylinder engine, developing 35-40 H. P., is mounted in front of the driving wheels, which are provided with short land grips, placed at right angles to the spokes; one of these wheels travels in the furrow. The driver is protected by a hood and the steering is controlled through the steering wheel placed behind the chassis.

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(1) See *R.* Sept., 1912, No 1331.

The lift is automatic when the reverse is put in. The width of the plough is about 4 feet.

The makers claim that the Excelsior will plough 7.5-12.33 acres in 10 hours at a depth of from 4-15 inches, consuming between 2.5-3 gallons of petrol per acre. At Chartres the Excelsior ploughed 4 174.56 sq. yds. in one hour. In the appended illustration the plough bodies are raised in order to show the position of the stays. A frame in sections, which bolts on to the projecting flanges of the grips is provided for road transport.

Excelsior motor plough

In the illustration the off-side driving wheel is completely fitted with this frame, the frame having been only partially fitted on the near wheel.

The Excelsior motor plough can also be used for hauling various implements and it is provided with a pulley mounted in front for belt-driven machinery.

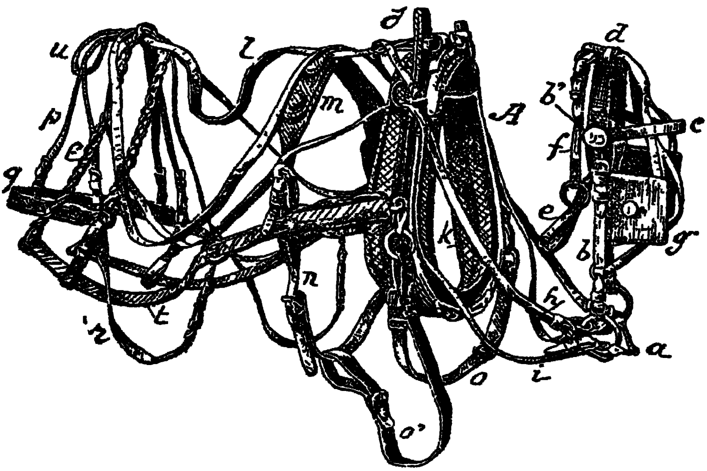
191 - **Horse Harness.** — RINGELMANN, M., in the *Journal d'Agriculture pratique*, Year 8, No. 53, pp. 533-534 + 2 figs. Paris Dec., 30, 1920.

Several articles were published in 1919 by the *Journal d'Agriculture pratique* on harness for farm horses. The type of harness which required examination most was that of the liberated regions of France where reconstruction has to be proceeded with as quickly as possible. This is why studies were made of the harness of the following departments of France: Nord, Pas-de-Calais, and the Aisne (1919, No. 24 and 1919,No 13), Somme

(1919, No. 26) Marne (1919, No. 45), Ardennes (1917, No 13 and 1919, No. 29), Lorraine (1919, Nos 16 and 34) then certain types of interest to the departments of Meurthe-et-Moselle, Meuse, and Vosges (1919, No. 10). In these studies the weight and sizes of all the chief part were given remembering that the dead weight of the harness should be reduced without impairing its strength.

American harness (see figure) is generally lighter than that used in France, Gt. Britain, Brittany, Luxemburg, Holland and most probably in the Rhineland.

The headstall comprises a snaffle bit *a*, cheek straps *b*, and rosette *b'* brow band *c*, crown *d*, throat lash *e*, lash strap *f*, blinkers *g*, reins *h*, and guides *i*. The pull is taken by the collar furnished with wooden hames *j*, and padding *k*. The leather traces *t* are long and end in the chain traces *t'*. They are held by straps from the saddle *m*, and a girth *n*. A shaft strap *o* is fastened to the collar for use with mowers and harvesters. In France, this strap is fastened below the collar and frequently gets in the way of the horse. This is reduced by fixing a support or forecarriage to the shafts of the mowing, reaping and harvesting machines. At *o'* is a spacing strap. The breeching consists of a long crupper *l*, passing from the collar, under the saddle and finishing in a tail-band *u*; hip-straps *p*, support the breeching *q*, which is jointed to the traces, just behind the girth, by breeching straps.

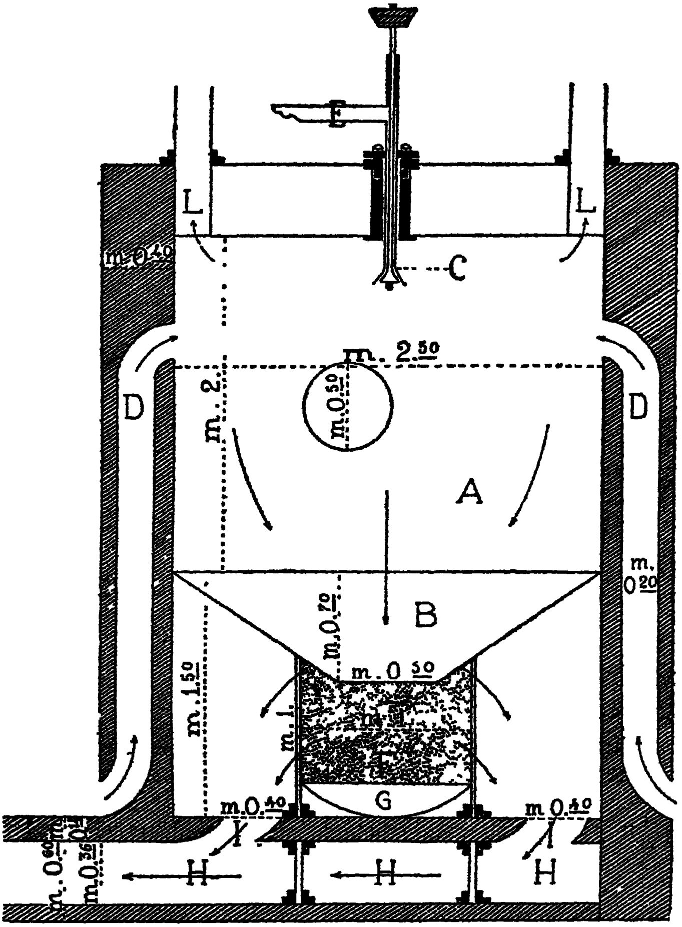


American harness.

This American harness is made of black leather, with a felt collar band and is very well finished

192 - **A Hot-Air Drier for Making Soluble Milk Powder.** — CABIZZA, A M (Buenos Aires), in *L'Agricoltura coloniale*, Year XIV, No 8, pp 321-325 + fig 1 Florence, Aug, 1920

Milk powder, as made in Australia, Madagascar, Liberia, etc., by machines with cylinders superheated with dry steam at 115-120°C is insoluble and, consequently, unable to replace natural milk. On this account it is not much used.



Hot air drier for making soluble milk powder.

The author has invented a hot air drier (CABIZZA, Patent No. 15 665 Argentine Republic) which produces perfectly soluble milk powder retaining its natural colour i. e. , which has not been partially burned.

This drier consists of a chamber *A* built of insulating material such as reinforced concrete lined internally with porcelain, an inverted funnel *B* also lined with porcelain, a sprayer *G* which can be regulated from the outside and has an inlet pipe *E* which communicates with a copper circular tank. The recipient *G* is provided with a hole and discharge pipe *H* with ports at *I*. Four inlet pipes *D* in the walls of *A* admit hot air from a furnace. The milk is previously heated and passes into a compression chamber whence it passes at a pressure of 10-12 atmospheres into the pipe *E* and thence into the sprayer *C* which sends it into the chamber *A* in a fine spray. Here it comes into contact with a continuous stream of hot air from the pipes *D*, by which the solids are separated from the vapour, which escapes through the exhaust ports *L*. The solid matter falls in the form of a fine powder arriving at its maximum dryness just as it passes through the funnel *B* into the recipient *E*. From *F* the milk powder falls into *G* whence it is aspirated into a recipient placed out of contact with the heat whilst the hot air passes out through the fine meshes of the recipient into the exhaust *H*. The circulation of the air through the furnace into the chamber is maintained by one or more pressure fans.

With this method, coagulation of the casein and carbonisation of the sugar which renders the milk insoluble, is avoided. The milk does not come into contact with any metal during this process, and it occupies the greatest possible area as it is in the form of very small globules, so that these are thoroughly dried. As regards yield, 100 litres of fresh milk give 12.5 kg., of dried milk. The cost of a plant capable of treating 10 000 hectolitres a day is 500 000 *pesos* (£ 100 000 at par).

The author considers that this industry should be taken up in countries such as the Argentine, which are rich in cattle and where the cheese industry is of secondary importance and in those countries such as Italy, where there are fewer cattle. but the cheese industry is well developed so that the cheese factories can dispose a much larger amount of milk.

193 – **The Round Barn.** — Fraser, W. J., in *Circular No. 230, University of Illinois, Agricultural Experiment Station*, pp. 3-52, figs 52. Urbana, Illinois. September 1918.

The author states that the round barn may be adapted to the requirements of various types of farming and that the farmers who had already used them were unanimous in declaring them economical in construction and convenient for the feeding and care of stock. The circular construction takes advantage of the lineal strength of the lumber, which is some twenty times that of the cross-grain shearing strength, thus making it possible to use smaller or fewer pieces than are ordinarily used in a rectangular structure. The studs in a round barn may be placed 2 feet to 2 feet 6 inches apart, in comparison with the 16 inches spacing in the rectangular form; yet the circular wall is stronger. Another item of economy is in the requirement of less framing lumber as not a single framing timber larger than 2 × 8 feet is needed above the joist. If the siding is put on vertically and a hip roof is built, no scaffolding is required inside or out during construction

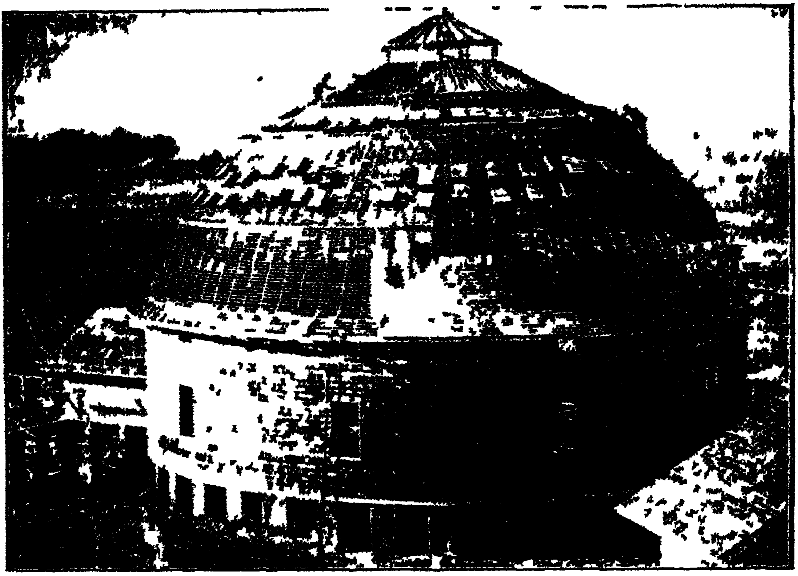


Fig 1 Circular barn during construction

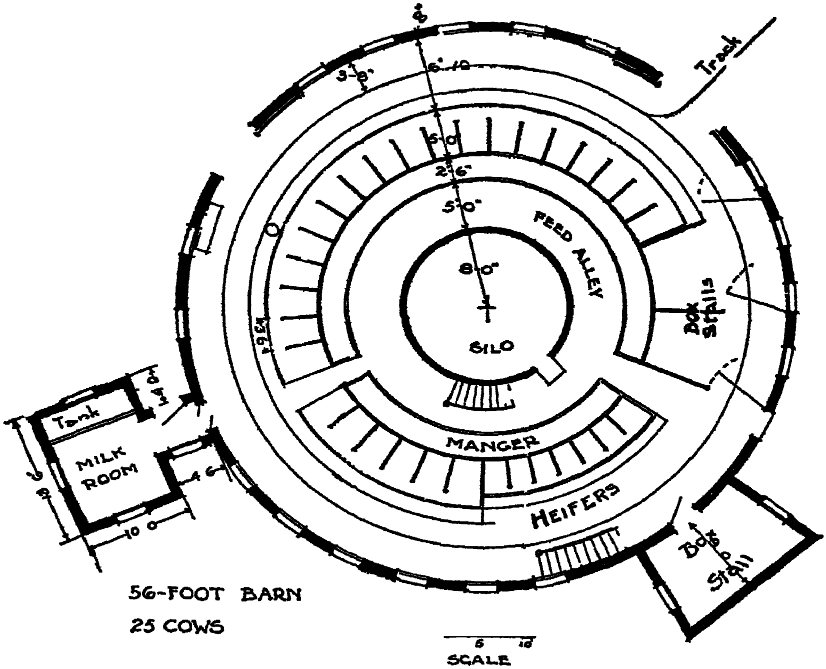


Fig 2 Plan of a circular barn for 25 cows

The objections raised with regard to the difficulties of lighting, and that rectangular objects cannot be placed in a circle without waste of space can easily be overcome, by properly spacing the windows well up towards the ceiling and by building circular silos etc,, and especially designed hay tracks A high board fence radiating from the barn acts as a wind break.

A comparison between the amount and cost of material in round and rectangular barns has been made by an expert barn builder. Round barns 600 feet and 90 feet in diameter, constructed entirely of wood are compared with both plank and mortise frame rectangular barns containing the same number of square feet of floor space.

Round and rectangular barns of the same area and with 20 ft posts not including foundation and silos.

Materials	Round barn 60 ft in diameter Per 1000 ft.	Rectangular barn 31 × 78 ½ feet Plank frame	 Mortise frame
Framing lumber.	13 976 ft. at $ 33 =$ 461.20	19 833 ft. at $ 33=$ 654 49	29 074 ft. at $ 33=$ 959 44
Sheathing siding and flooring	12 971 ft. at $ 35=$ 453 98	15 355 ft. at $ 35 = 537.43	15 355 ft. at $ 35=$ 537.4
Shingles	14 000 ft. at $ 4 50=198 00	45 000 ft. at $ 4.50 = 202 50	45 000 ft. at 4.50 = 202.50
Bolts	—	20 88	—
Total cost of lumber . .	$ 1 113.18	$ 1 415 30	$ 1 699 47
Proportional cost . . .	100 %	127 %	153 %
Content, cubic feet . .	117,669	117,128	117,138

The rectangular barn has stall room for two more cows than the 60 feet round barn but this is compensated for by the fact that the latter contains space in the centre for a silo 18 feet in diameter.

A 90 foot round barn with 20 foot posts has a capacity of 33 000 cub. feet in excess of the rectangular barn measuring 32 × 36 feet with 20 foot posts and with a stable below.

Full details with illustrations are given showing the roof cupola, and door constructions and the hay outfits. The diagram shows a round barn that is giving satisfaction.

RURAL ECONOMICS

194 - **Agricultural Accounting in Norway during 1918 and 1919.** — *Tidsskrift for det Norske Landbruk*, Year XXVII, Part 8, pp. 312-319 Christiania, Aug, 1920.

For the agricultural year 1918-1919, there were 28 accounts sent in by Ostlandet, 18 by Tröndelagen 24 by Vestlandet, 21 by Sörlandet, 7 by Nordre österdalen, 4 by Nordland or 102 in all. The period covered is from April 1, 1918 to March 31, 1919.

The prices of the chief agricultural products have risen in comparison with 1917-1918, but not to such an extent as in 1916-1917 and 1917-1918. In certain cases the price of cereals showed a tendency to fall.

TABLE I. — *Average percentage yield of the chief crops.*

	Hay		Seeds of forage grasses	Cereals				Potatoes	Turnips
	Artificial meadow	Natural meadow		Oats	Barley	Rye	Wheat		
	Percent	Percent	Percent	Percent	Percent	Percent	Percent.	Percent	Percent
Östlandet .	90	90	76	94	92	96	97	84	97
Trondelagen .	118	84	86	102	97	77	95	108	98
Vestlandet. . . .	98	90	—	101	93	53	85	78	110
Sorlandet . .	88	92	110	89	95	98	91	92	69
Nordre Osterdalen	101	98	—	—	76	—	—	91	81
Nordland . . .	98	89	—	83	112	—	100	105	—

TABLE II — *Average value, in Krona per unit area of cultivation*

	Ostlandet	Trondelagen	Vestlandet	Sorlandet	Nordre Österdalen	Nordland
Area of farms (1) .	295 5	163 2	55 1	80 9	77 3	95 8
Per area unit :						
1) Land capital	294 46	281 11	411 31	480 47	391 15	244 25
2) Gross receipts	139.17	146 30	141 39	195 17	120 84	118 71
3) Expenses . .	73 51	70 20	106 60	132 03	84 85	52 59
4) Net receipts.	63 66	76 10	34 79	63 14	35 99	66.12
5) Interest on circulating capital	22.67	27 4	8 67	13 01	9 85	24.83

(1) According to a publication by the Norwegian Agricultural Statistics office, th unit of area (not specified here) appears to be the *Maal A erland* of 0 9844 hectare 1 gol Krona = 1.389 fr. at par (*Fd*)

This table shows that the circulating capital has increased since th preceding year, owing to the continual rise in prices.

The Superintendents' salaries in Kronor per day, those for 1917-191 being given in brackets, were as follows — Ostlandet 12 11 (18 76) Tröndelagen 9 67 (7 38) ; Vestlandet 9 78 (6 57) , Sörlandet 10 38 (7.29) Nordre Osterdalen 9 77 (6 57) ; Nordland 9 55 (6 75)

Labourers' salaries per day averaged 9 28 kr in summer and 8 26 kr in winter.

The net receipts have greatly increased in Nordland and Tröndlage not so much in Ostlandet, and are roughly the same as the preceding yea in Vestlandet In Sorlandet they have decreased by 10 % and in Nordr Österdalen by 20 %.

TABLE III. — *Cost of cultivation and gross receipts in Krona per unit area*

	Östlandet	Tröndelagen	Vestlandet	Sörlandet	Nordre Österdalen	Nordland
Expenses:						
Fertiliser	5.39	4.23	2.61	7.08	1.76	1.97
Concentrated goods	11.75	6.53	4.68	19.11	6 31	4.25
Manual labour	43.14	48.71	85.60	84.47	64.01	38.96
Other expenses	15.83	10.73	13.71	21.37	12.77	7.41
Total	**75.51**	**70.20**	**106.60**	**132.03**	**84.85**	**52,59**
Gross receipts:						
Crops	64.90	59.96	27.10	57.08	7.39	30 63
Cattle	69.30	81.07	102.45	171.51	108.18	84.69
Land and house rents	3.86	4.29	7.36	4.54	4.93	2.85
Other receipts	1.11	0.98	4.48	2.04	0.24	0.54
Total	**139.17**	**146.30**	**141.39**	**195.17**	**120.84**	**118.71**

These tables show that the results were, on an average, very good in all the provinces, and that it can be said that those farmers who sent in their books are possessed of intelligence and energy superior to the average in their respective provinces.

195 – **The Cost Price of Wheat in the Region of Toulouse and the Pyrenees, France.** — COUZINET, in *La Vie Agricole et rurale*, Year IX, Vol. XVII, No. 41, pp. 231. Paris, Oct., 9, 1920.

The following statistics give the average production of wheat per hectare in Toulouse and the Pyrenees.

	Francs
12 hl. per hectare at 88 fr. per hl	1 056
Value of straw 15 fr. per 100 kg.	180
Total per hectare	**1 236**

	Francs	
Labour: 3 preparations at 150 fr p. prep. per h. or per 12 hl, i. e. 450 fr. for 12 hl. per 1 hectolitre	37.50	
Fertilisers: 400 kg. superphosphate per h., 120 fr. for 12 hl. per 1 hl.	10.00	
Seed: 2.40 hl. per h. at 90 fr. per hl. 216 fr. per h. per 12 hl., per hl.	18 00	
Two harrowings and 1 weeding: first to cover seeds, second, in spring, to break down surface at 60 fr. per hectare, per 1 hl.	5.00	
Cost of harvesting: Stacking, transport, threshing, preparation. — *Note*: Because of laid straw in some parts, manual labour is necessary	10.00	
Carried forward	80.50	**1 236**

	Francs	Francs
Carried forward . . .	80.50	1 236
Cost of threshing: Contractor per hl.	3.00	
Coal, 450 kg. per 100 hl.: 50 fr. per 100 kg. storage: i. e. 225 fr. i. e. per hl.	2.25	
Food for 3 contractor's men: 45 fr. per day or per 100 hl: 8 i. e. per 1 hl.	0.45	
Staff. 20 persons at 15 fr. per day (food included), i. e. 300 fr. per 100 hl	3.00	
Loss due to bad weather, breakages to machine, moving, and contingencies	1.30	
Total cost price per hl. . .	90.50	
Therefore per hectare 90.50 × 12 = ...		1 086
Difference or profit		150

This profit will pay the " fermage " or interest on land capital, ensure the upkeep and amortisation of material, etc.

196 – **Cost of Pork Production.** — See No. 184 of this *Review*.

AGRICULTURAL INDUSTRIES

197 – **Apiculated Yeasts in the Fermentation of Wine.** — De Rossi, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, Parts 7-8-9, pp. 233-297 + 8 diags., bibliography of 134 works. Modena, 1920.

Apiculate yeasts are widely distributed in nature. They not only take part in the process of vinification of fruit juices, but also in a number of other spontaneous processes of alcoholic fermentation. Different authors have given these yeasts a considerable diversity of characters. It is due to this that the conviction has been held for a long time that they comprise a certain number of distinct races of varieties as regards appearance, size. fermentative activity etc. Recently it has been demonstrated that the collective species *Saccharomyces apiculatus* can be divided into several distinct species. Some of these, capable of producing spores, belong, according to Zikes, to a new genus, *Hanseniaspora*, whilst the asporigenous forms for which the name *Saccharomvces* appear unsuitable, has been named by Klöcker as *Pseudosaccharomyces*. Klöcker has described 16 species of *Pseudosaccharomvces*, but the differences between their characters are not very clear and it is certain that more careful examination would reduce their number considerably. Will has described 3 species which he named *Pseudosacch. vini* and *Pseudosacch. cervisiae*.

The author has found, on the grapes and in the must of the Umbrian region, 2 apiculate forms, which a microscopical examination of recently prepared cultures, has served to differentiate clearly and which show different physiological aptitudes. One form showed characters that closely resembled those common to apiculture ferments, and the author proposes to call it *Pseudosacch. apiculatus*. The other, which is more rarely isolated, the author names *Pseudosacch. magnus.* The author has not thought it opportune to try to subdivide these 2 species still further according to the differences which can be observed in the various strains which were examined; these differences, generally of a quantitative nature, were very slight, and did not group together sufficiently to constitute the characters proper to one or more parent strains *Pseudosacch. apiculatus* is a low yeast, whose cells, in liquid or solid cultures of recent date appeared chiefly apiculate. Only a few are oval or assume another form. They are isolated or united two by two; they usually measure 3.4 to 6 × 1.5 to 3.2μ but some are much larger. They stain with Gram's stain, and they sometimes show the reaction of glycogene. They often contain metachromatic granules and corpuscles which give the microchemical reaction of fats. Spore formation has never been observed. Grape must, a decoction of glucose yeast, as well as gelatine and agar prepared with these liquids, makes excellent cultures for growing *Pseudosacch. apiculatus.* It will grow equally well on other nutritive media, provided that they contain glucose. The minimum temperature for growth varies between 1° and 3.5°*C.*, the maximum between 31° and 33.5°*C*; the lethal temperature applied for 10 minutes to cells suspended in grape must is 44°-47°*C.* All the strains of this species will ferment glucose and alvulose, but not maltose or lactose, nor saccharose, except about twice out of 39 times. The quantity of alcohol produced in 20 days, at 15°-18°*C.*, from grape must was 3.15-4.55 % by weight. This species also considerably reduces the fixed acidity of grape must and it produces a rather large quantity of volatile acids. It sometimes resists 0.3 per 1000 of metabisulphite of potassium, sometimes none at all, it is thus much more sensitive than the ellipsoid ferment to the action of this antiseptic.

Pseudosacch. magnus is also a low yeast which in recent cultures shows large apicula cells, generally of uniform appearance and size, they measure 4.8 to 9 × 2.7 to 4.8 μ and are isolated or coupled, or even especially during the firsts tages of development, arranged in groups of 3 or 4, without lateral ramifications. When the culture is growing old very varied, forms of cells appear. Numerous other characters of this species resemble those of *P. apiculatus,* with the following exceptions: – 1) The gelatin is liquified; 2) the temperature of maximum growth is 33°-35°*C*; 3) The lethal temperature for 10 minutes in grape must, is 49°-50°*C*; 4) the amount of alcohol produced in 20 days at 15°-18*C* from grape must is 8.30-9.15 % (by weight); 5) the quantity of metabisulphite of potassium resisted is 0.7 per 1000. This species cannot be identified with any of those previously described. The author's researches have shown that *P. apiculatus* has a much smaller activity and fermentative power than *S. ellipsoideus* whilst *P. magnus* in the first place has a weaker fermentative but a slightly superior fermentative capacity than the races of *Sacch ellipsoideus* experimented on by the author. The two apiculate species are equivalent as far as they cause, compared with the ellipsoid ferment, a greater decrease in the fixed acidity of grape must and a greater production of volatile acidity.

The well-known fact that *P. apiculatus* grows much more rapidly than *Sacch. ellipsoideus* has also been confirmed; for this reason the apiculate yeast dominates in the first place in grape must which contains the two blastomycetes. But as it is very sensitive to the action of alcohol, it soon suspends growth and after some days it decreases in number whilst the ellipsoid type continues to increase, so that by the end of the fermentation it greatly predominates and often appears to have completely replaced the apiculate forms. As for *P. magnus*, the author states that its vegetative activity is nearly equal to that of *Sacch. ellipsoideus*, but it is the first to become exhausted in the symbiosis of the two yeasts, so that by the end of the fermentation the ellipsoid species dominates.

The numerous experiments made by the author under different environmental conditions and with various media prove that *P. apiculatus* and *P. magnus* do not at all alter the result of fermentation, when they develop in the must at the same time as *Sacch ellipsoideus*. The speed of fermentation is slightly less because of *P. apiculatus*, but in this case the final result, *i. e.* the alcohol content of the wine, does not differ from that produced by *S ellipsoideus* alone. Liquids which have undergone mixed fermentation have generally less fixed acidity than those fermented with the ellipsoid yeast only; and the volatile acidity also is not increased more than by the mixed ferments, but is sometimes a little less. The author does not agree with the current opinion, based on the experiments of MÜLLER-THORGAU and others, that apiculate ferments, competing with ellipsoid yeast, have an unfavourable influence on wine-making from grape must by rendering the fermentation incomplete; it does not appear that they produce a disagreable taste and smell.

Several experiments on wine-making confirm the fact that the activity of *P. magnus* is not harmful. When the pure culture of this blastomycete was added to a must, the spontaneous fermentation of which had been stopped by sulphuration, the benefit of a slightly increased yield of superior tasting alcohol was obtained, not only in comparison with that obtained from the spontaneous fermentation of non sulphurated must but also with that of sulphurated must inoculated with a pure culture ot *Sacch. ellipsoideus*.

198 - **Causes of the Disappearance of Coal-Tar Dyes in Wine** (1). — MAZZARON, A , in *Le Stazioni sperimentali agrarie italiane*, Vol LIII, Parts 4-5-6, pp. 172-183, bibliography of 9 publications. Modena, 1920.

The author has previously shown that coal-tar colours added to wine in time undergo changes which can not be discovered with the usual analytical methods; hence the importance of all research on this subject, not only because of its bearing on the laws regulating the sale of wine but also to establish the causes and conditions which are most favourable for this process, and by what agency the colour is made to disappear.

The author summarises the researches of FALLIÈRES, MARTY, CAZE-

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(1) See *R.* May 1920, No. 580. (*Ed*)

NEUVE, MONARON, and others, and then describes his own work, and draws the following conclusions: —

Light is the principal, perhaps the only, agent of the phenomenon, but its action is subordinated to the presence in the wine of natural or unnatural substances, such as lactic acid, malic acid, citric acid, sulphur dioxide, sulphites, etc.

The chemical action leading to the transformation of the dye may be as much due to oxidation as to reduction.

All, or nearly all, the commercial dyes sold for this purpose undergo the same process. Oenotamic and other substances natural to the wine will not always form precipitates when artificial colouring is added to the wine, since oenocyanine and oenotannic acid added to distilled water containing a dye do not give a precipitate, and since, in some sterilised wine, the dye disappears, a precipitate being formed.

Neither is the alteration of the composition of the wine due to micro-organisms a direct or sole cause of the disappearance. But they may help by producing substances which facilitate the action of the light.

It does not follow that, as FERRAND believes, the dye added to the wine may cause the alteration and subsequent transformation

The author concludes by remarking that in all law-cases of fraud in connection with wines, the wine, before examination should be kept in coloured, non-transparent bottles and as much as possible shaded from the light.

199 - **The Disadvantage of Using Yellow Paraffin Oil in Wine Making.** — GRIMALDI, S., in *L'Italia vinicola ed agraria*, Year X, No. 50, pp. 597-598. Casalmonferrato, Dec. 12 1920.

The oil colour for wine making recently put on the market is stated by the author to consist of paraffin coloured yellow by tropeoline, and he draws attention to the fact that this coal-tar colour passes with the oil into the bottled wine, thus producing illegally an artificial colouration of a wine that is otherwise unadulterated.

On account of this the Italian Ministry of Agriculture ordered by circular, No 24,609 of Sept. 8, 1917, that paraffin oil coloured yellow by tropeoline, called also " enolio " should not be used in wine making.

200 - **Levulose Syrup and its Possibilities with Artichokes.** — WILLAMAN, J. J. (University of Minnesota), in *Science*, Vol. LII, No. 1346, pp. 351-352. Lancaster, Pa., October, 15, 1920.

The possible yield of sugar from the Jerusalem artichoke compares very favourably with that of other sugar crops, and the author considers that levulose syrup from artichoke tubers is one of the most promising of sugar possibilities. This in the form of inulin is found to the extent of 12 to 14 % in the fresh tuber. Assuming 40 000 lb. per acre and a 10 % recovery of inulin, there would thus be 4 000 lb. of sugar per acre. Compared with this; an acre of good sorghum yields about 1 600 lb. of sugar; an acre of sugar beet 3 000 lb; an acre of sugar cane 3 000 to 4 500 lb. These figures are estimates based on known yields and analyses of artichokes. Although the direct method of isolation of the inulin and its hydrolysis to levulose on a commercial scale is uncertain, the knowledge of the chemistry of these substances makes it very probable that the problem connected with the manufacture of levulose syrup could be solved. The question of the cost of production is at present unknown, but as the resultant product would be decidedly sweeter than any of the present sugars, it would be worth considerably more, in spite of the fact that the actual cost of manufacture might be higher

In view of the obvious advantages connected with this product, the author advises the inauguration of investigations in order to still further augment the present sources of sweetness.

201 - **Nomenclature of Flours, Starches, and Fecula.** — I LINDET, in the *Comptes rendus de l'Académie d'Agriculture*, Vol. VI, No. 38, pp. 903-904 Paris, Dec. 15, 1920. — II. JUMELLE, H, *Ibid.*, Vol VII, No 2, pp. 50-51. Jan. 12, 1921.

I. — The "Chambre syndicale des fabricants de glucose de France," considering that the names "flour," "starch" and "fecula" were badly understood both in Customs tariffs and in commerce generally, asked M ARPIN, an expert on these matters to report on this sybject.

M. LINDET communicated the main points of this report to the Academy:

It is not difficult to define the name "flour":— Flours are the produce obtained by milling plants containing starch as well as nitrogen and salts. But this does not hold for starch and fecula. Usually the name starch is given to the amylaceous substances which are found in the aerial organs of plants, such as maize starch, wheat starch, rice starch. Fecula is defined as the amylaceous substances contained in those parts of a plant which grow under the ground, such as the fecula of potatoes, etc.

But to this loose definition, M. ARPIN adds another and says that starch from seeds has the singular property of forming small columns called needles or crystals, when dried under certain conditions, whilst fecula always remains as powder, no matter how dried.

M. ARPIN suggests that this method should be used for defining amylaceous substances instead of by their origin in aerial or sub-terranean parts of the plant.

II. — M. JUMELLE states that the term starch is generally used for amylaceous substances extracted from grain, and fecula for that extracted from any other part of the plant.

For example the name fecula is given to very different amylaceous substances such as banana flour, feculant fruit such as bread-fruit, chayotte, etc., the trunks of palm-trees and of Cycadaceae (sagos), etc.

202 - **Variations in the Composition of wheat.** — LINDET, ROUSSEAU, E, and SIROT, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 31, pp. 753, 754, 758-762. Paris, Oct 27, 1920.

A note by MM. ROUSSEAU and SIROT communicated to the Academy by M. LINDET.

The authors have previously remarked that the quantity of soluble nitrogenous substances contained in good flour is very nearly constant, and that by this means the bread-making qualities of flour can be judged. Since then the authors have analysed wheat grain in all stages of development, including grain soaked by rain, to the time of germination. The proportion of the soluble to the total nitrogenous matter, which was 49 % at the end of June, fell to 10-14 % by the end of July, and increased to 36 % under the influence of germination.

The authors also studied the parallel progress of the soluble and total phosphates. The proportion of soluble to total phosphates was 76 % at the beginning of grain formation, fell to 35 %, and then reached 42 %.

The acidity follows the same curve; it started at 0.300, fell to 0.030 and rose again to 0.050. It can therefore be said, in agreement with previous research, that an abnormal composition of the wheat corresponds to insufficient maturation or a tendency to germination.

203 - **Action of Hydrogen Peroxide on Flours.** — MARION, in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 17, pp. 804-806. Paris, Oct., 26, 1920.

All flours contain a catalase in a quantity which varies with the degree of bolting; the by products from milling contain the maximum amount.

By measuring the volume of oxygen liberated in a given time from a given quantity of hydrogen peroxide a given weight of flour being used, an indication of the degree of bolting of the flour can be obtained. This method is more accurate and rapid than the various chemical methods employed.

204 - **Baking Value of Wheat.** — SANDERSON, T., in *Bulletin No.* 137, *Agricultural Experiment Station, Agricultural College, North Dakota*, pp. 1-45. North Dakota, May, 1920.

The data included in this Bulletin show the results of investigations for several years; for this reason only a summarised report for each one hundred experiments is given which shows:

1) The standard for the wheat flour;

2) The variation in quality and value of each sample, with the average result of milling and bread making classified in first and second grades relative to the yields 1916-1919.

The author maintains the opinion that if an adequate system of grading and determination of the milling and baking value is adopted, these experiments could be applied practically and would prove of considerable economic value.

205 - **Castor-Oil Industry.** — SHRADER, J. H., in the *United States Department of Agriculture Bulletin*, No. 867, pp. 1-40, Figs. 15. Washington, D. C., Sept. 3, 1920.

While castor oil from *Ricinus communis* is more widely known for its medicinal properties, its use is being constantly extended in a variety of industries. The hydroxylated condition of this oil is probably the property which renders it so valuable, for it is apparent that when other oils are treated so as to increase their acetyl number and their viscosity, they are more inclined to act in a way similar to castor oil e. g. the hydroxylation of acids normally soluble in gasoline, renders them insoluble, The industrial uses are enumerated as follows: — The manufacture of 1) artificial leather to impart softness and elasticity to the otherwise stiff product; 2) leather, to give flexibility to belting and for lubricating purposes; 3) emulsifying and cutting oils in connection with water; 4) Turkey red dye; 5) mantle dips; 6) linoleum; 7) rubber substitute (after treatment with sulphur and vulcanisation); 8) tire cement; 9) varnish; 10) textiles (castor soap oil); 11) copying inks, etc. For ordinary lubrication of machinery, the viscosity of this oil is its great asset and it is largely used by engineers.

In addition to details with regard to these uses, the author describes the analysis of a commercial sample of castor beans showing that the whole bean consists of 35 % seed coat and 65 % kernel, the oil content of these two parts being 10 and 62.9 % respectively. Contrary to the common belief that the colouring matter extracted by the solvent process is introduced through the so-called germs, it has been proved that the colour seems to be chiefly derived from the seed coats and is evidently not a single simple substance.

At least a small amount of acid was found invariably present in the beans. An acid determination of selected beans would create a standard towards which to work, although the percentage could not be realised in actual commercial practice.

The author touches also in detail on the following points: 1) trade and commerce; 2) the inspection and valuation of castor beans and 3) the manufacturing processes connected with castor oil.

I. — The normal annual consumption of castor oil in the United States is more than 2 000 000 gallons, and almost all is produced by her own crushing plants. The average annual importation of beans for the 5 fiscal years ending June 30, 1917 was about 834 00 bushels, and that of oil was comparatively insignificant.

The following Table shows the relative quantities imported from various sources during the years 1912, 1914, 1918.

Source	Relative importations of castor beans %		
	1912	1914	1918
United Kingdom	14.0	10.0	0.06
India	81.0	87.9	60.00
South America	4.6	1.0	19.00
West Indies	0.1	0.3	8.00

The author states that the great campaign of castor bean growing inaugurated in 1917 by the *Bureau of Aircraft Production* has led to the possibilities of creating a permanent American industry in this respect.

II. — To avoid judging the oil in the beans approximately only, it is suggested that the more logical proceeding would be judge them on the quantity and quality of the oil actually contained in the beans in addition. to the test for impurities. Methods at present employed are described in detail.

III. — After the cleaning process, the beans undergo decortication Owing to the peculiar structure of the castor bean, special machines have been built for this purpose to shake the kernels out of the adhering seed coats and otherwise to break up the mass. The next proceeding, namely heating, is to a large extent conducted on the " small assembled heater " system. The actual heating is effected by rising columns of hot air. The discharge may be made continuous or intermittent. Illustrations are given showing the construction of the above mentioned heater for this purpose.

As it is generally conceded that better oils are obtained when appreciable quantities of moisture are present it is advised that a jet of live steam should play into the descending current of material just before it enters the expeller. This gives a dry interior to the oleaginous material and a wet surface The drying effect on the beans would improve and greatly simplify decortication by rendering the seed coats more easily separable from the kernels.

In the past, plate presses and cloths were used for crushing the beans. This method has been abandoned for that of the " cage press. "

The other method used in modern oilseed milling which has been applied to castor bean pressing is that of expelling the oil in Anderson oil expellers. Unless proper care and skill are applied these machines produce an oil high in meal. Moisture and heating are therefore essential preliminaries. This process produces an oil of satisfactory quality for all industrial uses, and is especially suitable for aeroplane lubrication.

On account of the large proportion of residual oil left in the cake from the pressing or expelling operation (from 12 to 20 % or about 5 lb. to 46 lb. per bus), solvent extraction of the cake is universally practiced in America following the method generally applicable to oleaginous products. The units comprising a complete extraction plant consists of the extractor, the solvent recovery still, the oil-finishing still, the condenser, the solvent and water separator, pumps and s orage tanks. Two general types of equipment are used, namely, the stationary and the rotary extractors.

In the course of experimental work on the technology of castor-oil manufacture, evidence has been obtained which indicates that a satisfactory grade of oil, colourless and low in acidity, can be made entirely by the solvent process. As every expelling plant must have an auxiliary extraction equipment, this will mean a material decrease in the cost of production.

The only constituent of real commercial value obtained from the pomace is the ammonia and this is only the case when the moisture runs above 12 % and decomposition sets it.

A survey is given of the various refining and bleaching methods employed. The centrifugal separator is illustrated and is the machine by which meal and other substances are removed, and this leaves an oil with only a thin cloud but which can be treated with fuller's earth, bleached and filtered with much greater ease than with the bulky precipitate retained. Highly acid dark oil can be refined by alkali but not highly bleached while low acid oils can be refined and bleached to almost water white.

The quality of the oil is determined in trade by its colour, clearness and acidity. The specifications made by the Bureau of Aircraft Production giving the properties which a good grade of lubricating oil should possess. are as follows:

1) The oil may be either cold-pressed or hot-pressed and refined;

2) It must be free from adulteration, other oils, suspended matter, grit and water.

3) It must meet the following requirements.

4) When observed in a 4-oz sample bottle, the castor oil must be colorless or nearly so, transparent and without fluorescence.

5) Specific gravity = 0.959 to 0 968 at 60° *F* (Baumé gravity from 16.05 to 14.70 at 60° *F*).

6) Viscosity (tested in a Saybolt universal viscosimeter) not less than 450 seconds at 130° *F* and 95 seconds at 122° *F*.

7) Flash point not less than 450° in a Cleveland open cup-flash tester.

8) In a 4-oz sample bottle one quarter full, the oil must not congeal on being subjected to a temperature of 5° *F* for one hour.

9) The castor oil must not show a greater loss than 0.5 per cent when heated in an oven at 230° *F* for $1^3/_4$ hours.

10) It should not show more than 0.015 per cent of ash nor any impurity of any sort not related to the original product.

11) It must be completely soluble in 4 volumes of 90 per cent alcohol, specific gravity 0.834 at 60° *F*).

12) The acid number must be equivalent to no more than 1.5 per cent of oleic acid.

13) The unsaponifiable matter must not exceed 1 per cent.

14) The iodine number must be between 80 and 90.

15) and 16) The castor oil must not give a reaction either for rosin or rosin oil, or for cottonseed oil.

206 - **Research on Lemon-Oil.** — Bertolo, P., in the *Bollettino delle Sedute della Accademia Gioenia di Scienze Naturali in Catania*, Series II, Part 47, pp.28-31, Catania, 1920.

During the last period of the war, when the supply of fat was becoming very limited, the attention of the author was drawn to the lemon pips left as refuse in the " pastazzo " (marc) from the preparation of citrus products (" agrocotto ") such as calcium citrate, and citric acid. As yet this residue has no commercial value, being only used as manure and, in small quantities, as cattle food. The author therefore examined the oil derived from the pips to establish its nature, concentration, degree of saponification and other constants, and to ascertain its utility as a source of fat. These experiments were so successful that he advises the industrial extraction of lemon pip oil.

The extraction of the oil was made either by pressure or by the aid of solvents (carbon bisulphide, ligroin and benzene). The percentage of oil extracted by solvents varied from 30-35 %, according to the maturity of the pips. The oil obtained by expression is slightly fluid, with a clear yellow colour, an agreeable smell of lemon and slightly bitter taste. The oil apparently is a semi-drying oil and most nearly ressemble cotton seed oil in its characteristics, except that is does not give the HALPHEN reaction.

207 - **Cold Packed Canned Peas, Studies in the Heat Resistant Organisms.** — NORMINGTON, R., GILTNER W. and WYANT, Z N., in the *Technical Bulletin, Michigan Agricultural College*, pp. 5-33, Bibliogr. of 32 works. East Lansing, Michigan, November 1919.

The investigation was carried out with a view to determining the cause, of the very much larger proportion of spoilage among home canned foods compared with those canned commercially.

A comparison was made between peas heated in steam, those cooked by the hot water bath method, and those processed in the autoclave at 15 lb. pressure.

The percentage of spoilage was much lower in pint cans of peas autoclaved than in the other cases. This is the usual commercial method. The commercial canners found also that peas canned immediately after shelling had a comparatively low percentage of spoilage.

All the organisms found during these experiments were spore forming bacilli and resembled *Bacillus subtilis*, and other soil organisms. This indicates the importance of careful washing of peas and other vegetables before canning, in order to remove all soil and dust, and thus the greater part of the organisms.

All organisms withstood from 10-15 lb. pressure in the autoclave for 10 to 20 minutes. It is advised by the authors that the time for processing of vegetables should be lengthened so that the centre of the can may be at a high temperature sufficiently long to kill the more resistant organisms.

The steam pressure method is recommended for all cold packed canned vegetables to insure the greatest probability of success.

Details of the morphology, cultural characteristics, physical and biochemical features, and the temperature relations are given for each group of bacilli isolated. Nearly all the organisms reduced starch to sugar, seven caused peptonisation of milk, and one failed to produce indol from peptone. Eight produced gas in sterile peas but not in other media (*B. subtilis. B. ramosus*, *B. ruber*, *B. prodigiosus* and *B. viscosus*), which suggests additional possibilities in differential identification tests.

The results obtained in the chemical analysis of spoiled peas leads the authors to suggest that the determination of creatinine and ammonia, especially the former, may serve to detect bacterial decomposition in this canned food product.

208 - **The White Cherry Industry.** — I. PARIS, G., in *Le Stazioni sperimentali agrarie italiane*, Parts 4-5-6, pp. 187-227, + 1 fig. Bibliography of 12 publications. Modena, 1920. — II. CARRANTE, V., in *La Propaganda agricola*, Series II, Year XII, No. 22, pp. 342-348 + 2 figs. Bari, Nov. 30, 1920.

I. — The cherry tree is extensively cultivated in the province of Avellino. One tree produces about 2-3 quintals of fruit and most of the crop is exported. Formerly, only fresh fruit was exported but now the " cerise travaillée " *i. e.*, bleached with sulphur dioxide is almost exclusively exported. Before the war Germany, and now the United States consumed most of the exports. Avella and Tufino, and other hard and late cherries are preferred for bleaching. Up to now the operation has been done by empirical metods. The author proposes to replace these by methods deduced from his researches in the laboratory of agricultural chemistry of R. Scuola di Oenologia at Avellino.

The fruit is brought from the country in rectangular baskets 0.70 × 0.35 m. wide and 0.40 m. high. The cherries are then put into small crates, formed of strips with spaces of 7-8 mm. between, which are filled nearly to the top. The crates are then piled one on the other round the walls of the sulphuring room, leaving a space of 10 cm. between each pile and between each pile and the wall.

In bleaching, 20 kg. of sulphur is burned per 50 quintals of cherries, which are left in the room for 10 to 14 hours, according to their hardness. After bleaching, the cherries are put in a barrel filled with a solution of sulphur dioxide (about 40-100 mgm of SO_2 per kg.). Then 3 kg. of salt are added to each barrel, which is of 2-hectolitre capacity and holds 135 kg. of cherries. The cherries are sold for making jam, sugared fruits, etc.

During the sulphuring process the cherries do not lose weight, but when in the air they lose 1 % per day if hard and 2 % per day if soft.

The empirical method of preparing the sulphur dioxide and the sulphurous water (which usually is made by placing uncovered barrels full of water in a cellar and burning the sulphur in the chamber) has several disadvantages and sometimes causes alterations in the cherries, which, become pale and soft, with small cracks and spots on the skin which the author has identified as sub-centicular colonies of an ellipsoid alcoholic ferment (*Saccharomyces ellipsoideus*), with a stomate in the centre. The harm done to the cherries depends chiefly on the low concentration of the sulphur water used as the protecting liquid, on the loss of sulphur dioxide and to rough handling during sorting after the sulphuring. Absolute sterilisation of the cherries is obtained when there is not less than 80 gm., of sulphur dioxide per litre of water.

The normal constituents of the fruit with which the sulphur dioxide combines are principly aldehydes. It combines easily with sugars such as arabinose, lactose, mannose, and glucose. The hydrocarbons proper, starch, lactose, hemicellulose, etc., do not fix sulphur dioxide. Malic and tartaric acids will not fix sulphur dioxide, which combines but little with tannin and pectic substances.

Water can extract decreasing quantities of sulphurous acid from the sulphurated cherries.

This shows that the combinations which form between the colloid substances of the fruit and the sulphur dioxide are not very stable and that, in general, in casks full of cherries and sulphurous water, the quantity of sulphur dioxide contained in the cherries decreases, and the strength of the aqueous solution consequently increases.

The first step towards improving the industry is to utilise more rationally the sulphur dioxide obtained by burning sulphur. As the price of liquid sulphur dioxide is too high, the author advises the use of a tower of the GLOVER type, connected with a small sulphur or pyrites furnace, from the top of which a fine spray of water falls and dissolves the gas.

For work on a smaller scale a wooden tower, about 2 m. high, and with sides 50 cm. wide, containing a series of slightly sloping wooden baffles 40 cm. apart, on to which the water falls, is recommended. This apparatus is also advised for sulphuring grape must (SEMICHON, *Maladies des Vins*).

The cherries which have been stoved contain 500 mgm. of sulphur dioxide per 100 gm. of fruit, but nearly half of this is lost during sorting and grading. Hence these operations and that of putting into barrels should be finished as quickly as possible. Instead of using small crates in the stove, racks about 10-15 cm. broad may be used and so placed that the gas can circulate all round them, both above and below.

The sulphur furnace is placed between the piles of racks about 2 m from them and the earth so that the gas can diffuse evenly; 250 gm of sulphur is enough for each quintal of cherries, 500 gm. of sulphur dioxide being produced. After 6 hours the action is complete. It is best to admit a small volume of air through an inlet tube brought from near the ground outside to near the top of the chamber inside. Technically, it is not correct to admit sulphur dioxide already formed into the stove, as it has to be formed at the expense of the oxygen in the chamber and the results are much better.

This installation can be used for other fresh and also for dried fruits.

The preserved fruit and the grape syrup industries of the province of Avellino represent the best and most suitable means for dealing with large quantities of apples, plums, apricots and cherries, which in normal times fetch a low price only.

II. — DR. CARRANTE comments on the importance of the work of Prof. PARIS and gives some information concerning this industry in the province of Bari.

The importance of the industry in these two provinces is the same, as they both export about 1500 quintals of cherries per annum. In Bari the cherries are brought from the country in panniers. One kg. of sulphur is used per cwt. of cherries and they are left in the stove 5 hours. The barrels hold 2 hl. The amount of protective liquid per cask is 5 litres of water plus 500 gm. of metabisulphite of potash, plus 500 gm. of hydrochloric acid; the water is stirred and 500 gm of metabisulphite and 5 kg of common salt are added. The author advises the industrial establishments in Bari to adopt the improvements which are suggested by Prof. PARIS.

209 – **Use of Blood Serum to Replace Eggs in Making Alimentary Pastes. Some Experiments in Italy** (1). — ARIANA, G (Ufficiale sanitario e medico capo municipale a Reggio Emilia), in the *Industrie Italiane Illustrate* (I. I I), Number specially devoted to agriculture, foods, and food industries, Year IV, sect D, No 7, pp 25 Milan, July, 1920.

During the war experiments were made in Italy on the direct use of blood as human food; at Milan "blood bread" was made. At Reggio

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(1) For experiments made in France see *R.*, Oct., 1918, No 1168. (*Ed*)

Emilia the "Comitato per la disciplina dei consumi," on the authors' advice, made experiments on the preparation of alimentary pastes using blood serum instead of eggs.

The serum used was prepared at the Reggio Emilia Municipal Slaughterhouse. The blood was drawn direct from the animal (cow) in big copper caul drons, and was left to stand for 24 hours. The serum was then drawn by suction into glass flasks through rubber tubes. The preparation of the paste was not at all difficult. The flour was kneaded with blood serum (to which a small quantity of salt had been added) to bring it to the desired consistency. This was about 1 part by weight of blood to 3 of flour. The flour was then treated in the usual way.

During the first months of the winter of 1917-1918 the committee sold more than 1500 kg. of this paste, which looked and tasted the same as the commercial egg paste, but was not quite as yellow as the home-made article, in which 4 eggs are used per kg. of flour.

If 1 kg. of flour is kneaded with 4 eggs this gives about 20 gm. of protein and 19 gm. of fat and lipoid substances, 1 kg. of flour kneaded with 330 gm. of serum gives 25 gm. of protein and 1.5 gm. of fat and lipoid substances. The food value of this paste therefore is very little less than that made with eggs. The deficiency in fats and lipoids can be made up by seasoning.

The method used to separate the serum naturally and spontaneously from the coagulated blood was very satisfactory. Small quantities were used at a time and the glass receivers were easily washed, having glass tubes and rubber joints. For industrial purposes a much simpler method and apparatus is necessary. The author advises that the blood be defibrinated as soon as it is drawn by beating with rods or balls of glass or some suitable metal, then passing in the centrifuge.

It would be very profitable if a big slaughter house were to erect such an installation. An adult ox furnishes 25-30 litres of blood, giving 15-20 litres of serum. One litre of serum contains nearly 75 gm. of protein (calculated in the dried state), which is equal to that of 15 eggs.

The serum can also be used for other foods, such as confectionery, etc.

210 - **Payment for Milk according to its Fat Content.** — Porcher, C. and Vitoux, E., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol VI, No. 38, pp. 916-923., Paris, Dec. 15, 1920.

In certain countries milk is bought at a price in proportion to the fat content. The authors maintain that purchase on this basis is insufficient and ought to be supplemented by a factor relating to the quantity of dry fat extract. For this two very simple tests are sufficient, the first being the total fat content determined by the Gerber method and the second, the density of the milk. In addition the "freshness" of the milk, (microbial qualities and cleanliness) must be taken into account. The determination of the acidity of the milk, a usual dairy process, gives an approximate measure of the microbe content of the milk.

211 - **Manufacture of Soluble Milk Powder and the Successful Results to be obtained in the Italian Cheese Industry.** — See No. 192 of this *Review*.

212 - **Neutralisation of Cream. — Rate and Amount of Reaction in Certain Pasteurisers.** — RAMSAY, A. A., in *Science Bulletin* No. 17. *Department of Agriculture, New South Wales*, pp. 3-22 + 2 pp. graphs; Sydney, May 1920.

The laboratory experiments in neutralising the acidity of cream showed that in using sodium bicarbonate, as a neutralising agent, 94 to 104 % of the reduction, which should theoretically be produced, is obtained; and in using lime as a neutralising agent, 88-96 % is obtained.

The factory experiments were made to trace the decrease in acidity at various stages of the neutralisation and pasteurisation of cream for butter manufacture. The "flash" and "batch or holding" system of pasteurisation were employed.

The percentage amount of neutralisation effected in the two systems by using 1) lime and 2) sodium bicarbonate was as follows:—

	Flash			Holding	
	Lime	Sodium Bicarbonate		Lime	Sodium Bicarbonate
	%	%			
5 minutes after addition . .	68	85.9	10 minutes after addition .	65.2	62.5
10 » » »	70 5	96.5	15 » » »	69.9	67.3
15 » » »	72.4	102.7	30 » » »	74 5	77.5
During pasteurisation (additional).	24.1	10.9	60 » » »	86 3	80.1
Final result . . .	96.5	113.6	120 » » »	86.3	85.9

The action of both soda and lime when well mixed with cream was very rapid. The plant in the flash system consisted of two tanks, each of 200 gallons capacity, which were filled from the usual platform tank into which the cream was tipped as received from suppliers, and the usual flash pasteuriser. The method of working was to fill one of the tanks and determine the acidity of the contained cream. By mixing the lime and cream with a wood rake, an equilibrium of the mixture was quickly attained, and more rapidly and uniformly than with the holding system. When the mixture was complete, the contents of the tank were passed through the pasteuriser and collected in a receiving tank. While this was proceeding, the second 200 gall. tank was being filled to the 200 gall. mark, neutralised as above described, and was ready to be pasteurised as soon as the first tank was empty. The process worked smoothly and well.

The following is the chemical analysis of the crumbled lime-powder used: % moisture-nil-insoluble matter 0.28 — Oxides of iron and aluminium, 2.45. — calcium carbonate 4.55. — calcium hydrate, 73.64 — calcium oxide 19.06.

When the mixture was efficient, sodium carbonate was found quicker in its action than lime.

In the case of the holding vats, those containing small quantities of cream appeared to give a satisfactory mixture, but this was liable to become indifferent or even unsatisfactory when the vats were full.

The results, according to the author, open up a field of investigation, as to what becomes of the 14 % of the efficiency of the neutralising agents, when the holding system is employed, and as to the cause of the apparent ultra-theoretical neutralisation caused by sodium carbonate when used with the flash system.

213 - **The Frozen Meat Industry in Brazil** (1). — *Boletim do Ministerio da Agricultura, Industria e Commercio*, Year VIII, pp. 117-118 Rio de Janeiro, 1920.

Brazil has now 10 refrigerating establishments in full working order, 9 of them being under the control of the federal Government, whilst the other is under the Municipality of Rio de Janeiro. In 1918, 444 847 cattle were slaughtered as against 434,842 in 1919; the average price in 1919 being 185 *milreis* per head (One paper *milreis* = 1s 4d at par). The establishments in order of their capacity are: Rio Grande do Sul, S. Paulo, Rio de Janeiro, and the Federal District.

The following table gives details of the meat export:

Total for the year		Total January-August	
	Metric tons		Metric tons
1916	33 601	1916	19 714
1917	66 452	1917	47 281
1918	60 509	1918	45 751
		1919	30 325

214 - **Production and Sale of Wool in Argentina** (2). — In the *Revista de la Asociación rural del Uruguay*, Year XLIX, No. 7, pp. 501-504. Montevideo, July, 1920.

The stock of ordinary wool in the Argentine now reaches about 100 000 metric tons. This enormous accumulation is due to several reasons such as the closing of the factories of Northern France and of Belgium during the war, and an increased demand for fine wool, which gave a higher yield at spinning and could be manipulated more quickly. Today this demand for fine wool still continues, and although the export from Argentina rose from 187 885 bales in the period Oct. 1918-Oct. 1919, to

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(1) In connection with this subject see Dr. D. DE CAMPOS: A importação de carnes congeladas na Italia, in the *Republica dos Estados Unidos do Brasil, Boletim do Ministerio das Relações Exteriores*, No. 9. pp. 49-58. Rio de Janeiro, 1920. The author gives data concerning the consumption and supply of meat in Italy, predicts a great increase in Brazilian export trade with this market and suggests that financial help and organization will greatly benefit these two countries. (*Ed.*)

(2) See *R.*, July, 1913, No. 837; *R.*, Oct., 1913, No. 1199; *R.*, Jan., 1914, No. 45; *R.*, June, 1914, Nos. 551 and 552; *R.*, Nov. 1914 No., 1063; *R.*, Jan., 1916, No. 112; *R.*, Nov. 1916, No. 1122. (*Ed.*)

227 968 bales in the period Oct. 1919-Oct. 1920, the increase was exclusively in fine wool.

Thus this stock which was not more than 30 000 metric tons at the end of the war, has increased to about 100 000 metric tons distributed in the following centres: — about 25 % on the « Mercado de Frutos » about 8 % warehoused in the capital, and the rest on the farms. It is estimated that 50 000 metric tons is held by the sheep-owners, who are certainly the cause of the present accumulation; in fact, when the price fell from 27 *pesos* (1 *peso* = 20.99 *d.* at par) in 1918 to 18 *pesos* per 10 kg. in 1919, the owners refused to sell and stored the successive clips. As the offers were thus increased and the demand practically ceased, the price fell to 7.50-8 *pesos* per 10 kg.

The rate of Exchange in Great Britain, France, Italy, and Belgium and the increased rate of interest on capital have all had an effect on the lack of market for ordinary wools. Whereas, before the war, money could be borrowed at an interest of 3 or 4 % it is now 6-8 %. The buyers therefore hesitate to lock up money and prefer to buy as they need the material.

On the other hand it is probable that as the British factories will again begin to use ordinary wool and they cannot use the 700 000 bales from New Zealand before December, the Argentine should find a good market for its wool, especially because there is now a big demand for woollen goods and the output of the European factories is very small so that the demand for this wool should gradually increase.

The situation therefore is not without hope but the mistake must not be made of increasing the export of a commodity which abounds in the country and for which there is little external demand. The sales should be spread over a dozen years or so in accordance with the demands from foreign markets.

215 - **Treatment of Unripe Honey. Successful Experiments in Vacuum Boiling.** — WESTBROOKE, G. V. (Apiary Instructor, Auckland), in *The New Zealand Journal of Agriculture*, Vol. XX, No. 4. pp. 246-240. Wellington, April 20, 1920.

By the use of the hydrometer it has been possible to ascertain if honey was ripe before putting it on the market, but the greatest difficulty was to know what to do with honey below the standard gravity.

The author experimented with samples that had slightly fermented, and with a specific gravity of only 1.405. These were boiled for about 10 minutes in a vacuum flask at a temperature of 130°*F*. This boiling at a comparatively low temperature resulted in ridding the honey of its surplus moisture and in eliminating the froth and particles of wax etc. leaving it very clear. After this treatment the honey showed a specific gravity of 1.425.

As a result of this experiment, arrangements were made to treat a large quantity at the Colonial Sugar Refining Company's works and, in conjunction with the New Zealand Honey Producers' Association, about 6 tons of slightly fermented honey was secured from different parts of the Dominion. This honey on being tested, registered from 1.4 to 1.405 s. g.

and analysis showed that the water content was about 20 %. As it was more or less granulated it was found necessary to reliquefy by adding about 25 % hot water, and this enabled it to be pumped into a large vacuum vat. It was then boiled for over half an hour at a temperature of 120°*F*. Tests were made by the author during the boiling process and when a gravity of 1.425 was registered, the heat was shut off and the honey run into tins. It finally registered 1.432 which indicated a very ripe honey.

This honey after being thus treated showed no trace of fermentation, and the strong rank flavour and aroma prevalent prior to treatment, had now disappeared.

It is advised that such honey should be treated before the ferment germs start in it, thus effecting a large saving for the industry.

216 - **Influence of Fermentation on the Starch Content of Experimental Silage** (1). — DOX A. W. and YODER, L., (Iowa Agricultural Experiment Station) in, the *Journal of Agricultural Research*, Vol. XIX, No. 4, pp. 173-179, Bibliogr. of 13 works. Washington, D. C., May 15, 1920.

The work reported was undertaken to determine any changes the starch might undergo together with the nature of these changes and their relation to other important reactions occuring in silage fermentation. The experiments were made with field maize still green, dented and about at its glazing stage. Determinations were made for moisture, total acidity, alcohol, total sugar and starch, and qualitative tests were also made for the transitional products of starch hydrolysis, namely, soluble starch and dextrins.

From the results obtained the author drew the following conclusions : —

Changes in total acidity, alcohol, and sugar are entirely independent of the starch content of the ensiled maize of the silage produced therefrom

The silage solution, the medium in which fermentation takes place, which is in contact with the silage starch granules, reached a N/.04 concentration by the 8th day and almost N/0.5 by the 66th day. Most of this acidity was due to lactic and acetic acids. Strong acids must, according to this, be used and their dilute solutions must be heated. That there was no marked maximum production of alcohol at any time was due probably at first to oxidation of the acetic acid and later to esterification. Unless the rate of fermentation equals the rate of formation of sugar, no formation of sugar from higher carbohydrates, will be indicated after the 8th day.

The first intermediate products resulting from the decomposition of starch were not present in demonstrable quantities. The starch content remained constant throughout the fermentation process, and the granules remained intact, undergoing no physical change that could be detected by microscopic examination . The lack of consistency in the variations and their correlation with the other fermentation changes give further evidence that the starch is not changed.

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(1) See *R.*, Jan. 1915, No. 77; *R.* Jan. 1916, No. 119; *R.* Feb. 1916, No. 232; *R.* Nov. 1917, No. 1079; *R.* Feb. 1918, No. 121; *R.* Feb. 1919, No. 257; *R.* July-Sept. 1919, No. 1010; *R.* July-Aug. 1920, No. 802; *R.* Oct. 1920, No 1039. (*Ed.*)

Since starch constitutes about 10 % of the maize plant at the time of ensiling, and represents over 400 calories of available energy per kg., the fact that no loss occurs during fermentation is an additional argument according to the authors, in favour of silage as an economical food.

217 - **Investigations in the Ripening and Storage of Bartlett Pears** (1). — MAGNESS, J. R. (Bureau of Plant Industry, United States Department of Agriculture), in the *Journal of Agricultural Research*, Vol XIX, No. 10, pp 473-500, Figs. 8 Bibliography of 17 works. Washington, D. C., Aug,. 16. 1920.

The investigations were undertaken in order to notify: 1) The changes that take place in the pear from various parts of the Pacific coast during the time of development; 2) the effect of the time of removing the fruit from the tree on its content of acid, sugar, starch and moisture; 3) the changes in the fruit between the time of picking and the time it is in prime eating condition; 4) whether the temperature at which the fruit is kept during ripening has any appreciable effect upon its composition.

Attention is drawn to the fact that if this variety of pear is left on the trees until fully ripe it is of very inferior quality, and very often the inside becomes soft and decayed or coarse and granular. In most sections there is a period of from 6 weeks to over 2 months between the time at which the first commercial picking is made, and the time the fruit becomes ripe. Consequently, there is a possibility of considerable variation in the time at which the fruit may be removed and yet ripen without shrivelling. Hence the advisability of the investigations.

The author gives a survey of the work of former investigators who have studied the chemical composition of pears, and the influence of various environmental factors thereon, and also of the work done in connection with the storage, the effects of temperature and the methods of handling. Apparently the lower the temperature used, down to 31° or 32° *F*, (the lowest storage temperatures used in these experiments), the longer the storage season will be. Most rapid ripening is attained at a temperature of 70°-80°.

The results of all the analyses made by the author and summarised in comparison tables include all the data of fruit from orchards in California, Oregon and Washington. A review of the curves illustrating the development of sugar in the fruit at the various intervals at which pickings were made and the influence of various types of storage upon the sugar content indicates that whereas in the early picked fruit almost all of the sugar is in the form of reducing substances, the increase in reducing sugars in successive lots, as the season progresses, is much less marked than is the increase of sucrose. Pears ripened at 70 °*F* contained the highest percentage of sugar, those at 40° the lowest sugar content, and those at 30° for 6 to 14 weeks and then ripened at room temperature were intermediate in amount of total sugar. There was no marked relation between temperature of storage and relative amount of sucrose and reducing sugar. The percentage of titrable acid tended to decrease in the fruit from the California sections as the season advanced, but to increase in that from Oregon and Washington. There was an increase in acid between the time of picking and the time of full ripening when held at 70°*F*. The acid content of the fruit allowed to become well matured on the tree remained nearly constant during storage.

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(1) See also *R.* May, 1913, No. 534; *R.* October, 1920, No. 954. (*Ed.*)

There was a progressive reduction in the alcohol insoluble, acid hydrolysing reducing material as the season advanced, both in freshly picked fruit and the same after ripening.

For purposes of dehydration, pears left on the tree as long as possible were found to give not only the greatest tonnage but also the greatest weight of the dried product per pound of green weight.

An examination of the lenticels of the fruit freshly picked showed that if placed in methylene blue solution this readily penetrated the lenticels of the immature early picked fruit, but a brown suberose tissue was formed at the opening of the commercial season which prevented this penetration. This change in lenticels may be a valuable aid to present methods of determining when the fruit is in a condition to pick and handle without danger of shrivelling or wilting.

The percentage of total solids was lowest at the opening of the season and tended to increase with the accumulation of sugar in the late-picked lots.

The advisable conditions of storage are discussed and these are summarised as follows: 1) Use only well developed fruit for storage; 2) put into storage immediately after picking; 3) cool as quickly as possible; 4) maintain an even temperature and hold this down to 28° or 30°*F* if a long period of storage is desired; 5) the cooling capacity of the storage plant should not be overtaxed. With proper precautions of picking, handling and storing, Bartlett pears can be held 2 or 3 months in storage and then taken out in good condition.

218 - **Effect of Temperature on the Resistance to Wounding of Certain Small Fruits and Cherries.** — HAWKINS, L. A., and SANDO, C. E. (Office of Horticultural and Pomological Investigation), in the *United States Department of Agriculture, Bulletin*, No. 830, pp 1-6 Washington, D C, March 6, 1920.

The investigation was undertaken to discover whether small fruits when cooled were less liable to injury than if picked or handled when warm.

The fruits employed were raspberries, blackberries, strawberries and cherries.

Results showed that the average pressure required to puncture berries that had been cooled was considerably more than that required for warm berries. This was found to be the case not only for the freshly picked fruit but also for the berries maintained at ice box temperature (about 16°C) for 24 hours. Washing in tap water did not however apparently increase the resistance of the epidermis to puncture

These results bear out the advantage of picking the berries in the early morning when cool, in spite of the fact that they are frequently wet with dew, as no evidence was obtained that moist berries were more susceptible to injury than dry fruits.

The authors quote the results of experiments by other investigators proving that uninjured fruits are not so liable to decay from fungous infection as those which are injured, and that fruit cooled as soon as possible after harvesting, or picked when cool, are less likely to become infected

219 - **Preservation of Cut Flowers by Refrigeration.** — See No 159 of this *Review*

220 - **Protection of Potatoes from Cold in Transit. Lining and Loading Cars.**— *United States Department of Agriculture, Farmers' Bulletin* 1091, pp 3-27, Figs 22 Washington, D C, Feb, 1920

Recommendations for lining and loading cars for protection of the shipments against cold based upon commercial practices and the results of tests and inspections made by the "Bureau of Markets", supplemented by conferences with those actually engaged in this work Investigations are still in progress

Successful methods are explained concerning the packing in box cars, produce cars, refrigerators and heater cars. The protection from cold depends largely upon a constant current of warm air from the heater directly to the ceiling spreading between the latter and the top potatoes, thence through openings at the opposite ends of the load down to the space beneath the false floor and from under this to the heater again.

During the winter 1917-18 approximately 75 % of all cars prepared to protect potato shipments during the winter were either lined or loaded incorrectly and there was always a danger of overheating the potatoes at the top of the load, and at the same time allowing those on the floor to freeze.

PLANT DISEASES

GENERAL INFORMATION

221 - **The International Convention for the Control of Locusts Concluded in Rome, on October 31, 1920.**

A conference for the purpose of organising the international control of locusts was convoked, under the auspices of the International Institute of Agriculture by the Italian Government with the support of the French Government, and met in Rome, at the said Institute, on October 28, 1920.

The representatives of the following States took part in the proceedings; — Argentina, Belgium, Bulgaria, China, Cuba, Egypt, Spain, French West Africa, Algeria, Indo-China, Madagascar, Morocco, (French zone), Tunis, United Kingdom, Canada, Greece, Hungary, Italy, Erythrea, Italian Somaliland, Tripolitania, Cyrenaica, Mexico, Paraguay, the Kingdom of the Serbo-Croato-Slavonians, and Uruguay.

The conference concluded its labours by drawing up the text of the following Convention, which will bear the fixed date of October 31, 1920: —

Art. 1. — The contracting States pledge themselves to take all necessary measures for the control of locusts that may injure the crops of such neighbouring states as are signatories of the present convention.

Art. 2. — They shall at once take adequate measures to inform the neighbouring signatory States of the movements of locusts under the circumstances mentioned in Art. 1.

Art. 3. — They shall be empowered to make special agreements in their mutual interest as to the common measures to be adopted for facilitating the control of locusts.

Art. 4. — They recognise, from the date of the signing of the present convention, the International Institute of Agriculture, Rome as the International Official Centre for the recording and transmission of all information referring to the control of locusts.

They undertake to furnish to the said Institute, at least once a year, and oftener, if occasion requires, all the information, of a technical, scientific, legislative, and administrative character collected on this subject by competent persons.

The International Institute of Agriculture shall disseminate such information as widely and rapidly as possible.

Art. 5. — Any suggestion emanating from a Contracting State, and dealing with a modification of the present convention, shall be communicated by the said State to the International Institute of Agriculture, and shall be referred by the latter to a meeting of the Delegates of the Contracting parties which shall be convened in Rome by the International Institute of Agriculture, on the occasion of a General Assembly at the said Institute.

The proposals made by the Delegates shall at once be submitted to the approval of the States adhering to the present convention.

Art. 6. — The present convention shall be signed and ratified as soon as possible, and the ratifications shall be consigned to the Italian Government as soon as three at least of the contracting states shall have been able to execute them.

Each ratification shall be communicated by the Italian Government, both to the other contracting States, and to the International Institute of Agriculture.

Art. 7. — Any self-governing State, Dominion, or Colony that has not yet signed the present convention may become an adherent to it on request.

Colonies, on the request of the States of which they are dependencies, are admitted as adherents on the same conditions as sovereign States.

Art. 8. — Their adherence shall be notified through diplomatic channels to the Italian Government, and shall be communicated by the latter to the contracting Governments as well as to the International Institute of Agriculture.

Art. 9. — The present Convention shall come into force, at least as regards the three first States ratifying it, within three months from the date of ratification; and as regards the other States, within six months from the date of the consignment to the Italian Government of the document embodying their ratification or adhesion.

The present Convention has been signed by the plenipotentiaries of the States:— Argentina, Bulgaria, Cuba, France, French West Africa, Algeria, Indo-China, Madagascar, Morocco (French portion), Tunis, Hungary, Italy, Erythrea, Italian Somaliland, Tripolitania, Cyrenaica, Mexico, Kingdom of Serbo-Croato-Slavonians, Uruguay, and Greece.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

222 - **Damage to Plants due to Diseases and Insect Pests in the United States.** — See No. 124 of this *Review*

223 - **Deterioration of Certain Fruit-tree Varieties Caused by Bud Variations.** — See No. 148 of this *Review*.

224 - ***Sclerotinia pseudotuberosa*, the Ascophorous Form of *Rhacodiella Castaneae*, the Cause of Black Rot in Chestnuts** (1). — PEYRONEL, B., in the *Rendiconti delle sedute della Reale Accademia Nazionale dei Lincei, Classe di Scienze, fisiche, matematiche e naturali*, Vol XXIX, Part 10. pp. 324-327, Rome, 1920.

In order to complete what is known concerning the life-cycle of the hyphomycete *Rhacodiella Castaniae* (Bain) Peyr. — considered by the author to be the pathogenic agent of the " black rot " of chestnuts — its perfect form had to be discovered.

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(1) See *R*, July-August, 1919, No 1042 (*Ed.*)

After many attempts, the author succeeded in obtaining, in October, 1920, a culture of *Rh. castanea*, the ascophorous form of the fungus. It is a discomycete of the family Pezizaceae, being a member of the genus *Sclerotinia* described and identified by the author, at least provisionally, as *Scl. pseudotuberosa* Rehm, found on fallen acorns in Germany (Franconia, Brandenburg), France, and North America.

The author thinks that the morphological differences, especially those of the conidial form, between the acorn *Sclerotinia*, and that found on chestnuts, are to be attributed to an incomplete knowledge of the former, and also to the great polymorphism of the species, especially as regards its vegetative organs.

225 – **Behaviour of Various Spring Wheat Varieties as regards Rust in the Northern Great Plains, U. S.** — See No 150 of this *Review*.

226 – **Varieties of Swedish Barley Resistant to *Helminthosporium gramineum* and to *Heterodera schachtii*.** — See No 144 of this *Review*.

227 – **Potatoes Coming From Aerial Tubers Resistant to Mildew.** — See No 142 of of this *Review*.

228 – **Direct Hybrid Bearer " 4401 de Courdere " Resistant to Mildew.** — See No 165 this *Review*

229 – **Observations made in Italy on the Resistance of Certain Varieties of Peach to Peach Leaf-Curl (*Exoascus deformans*).** — LANDINI, L., in the *Bollettino della R. Societa Toscana di Orticultura*, Year XLV, Nos 9-10, pp 69-70 Florence, September-October, 1920.

The peach-trees in the orchard of the " R. Scuola di Pomologia " at Florence were treated once with a 3 % mixture of Caffaro paste, in 1919, before the buds opened. In 1920, three applications of 3 % and 2 % were made, at intervals of a fortnight, the last being on February 24th, a few days before the buds unfolded. The weather during both these years was favourable to the development of peach leaf-curl (*Exoascus deformans*).

The " Principe di Piemonte " variety obtained from seed by the " R. Scuola di Pomologia " is more resistant then all other kinds. It is a vigorous, free-growing, very productive tree, bearing very large peaches of fine flavour that ripen in September. It remained immune among other infected varieties growing not only on the same piece of ground, but even in the same row. After it, as a resistant variety, comes Morellona (Royal Morillon), of which the leaves were only attacked here and there,. This is followed by " Amsden, " "Tondona Presidente, " " S. Anna, " " Alexander," " Trionfo," late " Poppa di Venere," late " Cresole," and the " Cotogne " varieties, which all proved fairly resistant, especially " Amsden, " which is also one of the best acclimatised peaches. The varieties " Mamie Ross ," " May Flower, " " Regina dei Verzieri, " " Sneed, " " Maddalena Rossa, " "" Surpasse Amsden, " etc., were attacked more strongly. The most susceptible were " Elberta, " " Carman, " " Victor;" " Meraviglia d'ottobre, " " Bella di Georgia, " etc.

As a rule , trees of 8 to 12 years suffered more than younger ones which being less developed, were better aerated and more vigorous.

In order to strengthen the trees most exhausted by the disease, experiments were made in treating them with 2 quintals per hectare, or 200 gm. per tree, of sodium nitrate. Excellent results were obtained, many strong shoots were put forth, which soon entirely covered the branches, and all the fruit ripened perfectly.

From his experiments the author concludes that during years when the trees are much attacked, preventive applications of sprays with a basis of 3 % to 4 % of copper sulphate may check the development of the parasite, even on the most delicate trees, but cannot entirely prevent its appearance On the other hand the more resistant varieties of peach can easily be protected from attack.

230 - **Researchs Carried Out on "Arrabbiaticcio" in Italy.** — MORETTINI, A., in *Le Stazioni sperimentali agrarie italiane*, Vol LIII, Parts 4-5-6, pp. 146-166, Modena, 1920.

The name "Arrabbiaticcio" is given in Italy to the damage that is done to soil when it is worked under unsuitable, damp conditions. The same term is also applied to the abnormal growth of wheat cultivated on "arrabbiato" soil, that is to say, one which is damp on the surface, and dry below. The same condition is also called "guastaticcio" in certain parts of Itly and "terre-gâtée" in France.

The author has tried for ten years — at the Royal Agricultural College of Perousa — to induce this disease artificially either in receptacles filled with soil in pots, or in the field, by mean of mixing soil that is damp on the surface with the underlying dry soil. He however, always obtained negative results, and sometimes the products of the plots where he had tried to cause "arrabbiaticcio" were even better than those of the check plots. The author has thus been forced to discard the hypothesis that the disease is due to working the soil at unsuitable times.

In the many visits he paid to various parts of Umbria, the author was never able to determine whether the land producing "arrabbiato" wheat had been worked under bad conditions,. On the other hand, however he often found, that the withering of the plants was due to unfavourable soil condition, excessive damp, floods, parasitic insects, or fungoid disease. Among the last mentioned, straw blight (*Ophiobolus graminis* Sacc. and *O. herpotrichus* [Fr] Sacc.), is considered characteristic of so-called "arrabbiato" wheat ; in fact, according to the author, by "arrabbiaticcio," and its synonyms, the old agriculturists meant nothing else than the injury caused by the disease now known by the name of straw blight.

231 - ***Ovulariopsis Gossypii*** **n. sp. and** ***O. obclavata*** **n. sp. Fungi found respectively on** ***Gossypium barbadense*** **and** ***Tecoma leucoxylon*****, in the West Indies.** — WAKEFIELD, E M., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 7, pp 235-236, figs 1 London, 1920

Since 1906, a cotton mildew, popularly termed "West Indian Leaf Mildew" was notified in the West Indies. The occasional occurrence of a similar disease has been recorded in Bombay.

The disease occurs on both native and cultivated cotton Leaves attacked by the fungus turn yellow or red in irregular areas, often, at first, bounded by the large leaf veins. Finally the whole leaf is affected, turns yellow and drops off. The under sides of diseased leaves are covered with a white shining mildew, there is also an internal mycelium in the leaf tissues.

Since 1916, the disease has been recorded in varying intensity, but the fungus remained unidentified. Typical specimens of this cotton mildew, found on old leaves of Sea Island Cotton (*Gossypium barbadense*) and, also of a somewhat similar mildew on *Tecoma leucoxylon* were submitted to Kew in 1920 from the Barbados for identification.

Microscopic examination at once showed that both belong technically to the genus *Ovulariopsis* Pat and Har; and the author considers it advisable, for the present at any rate to give these forms distinctive names:— *O. Gossypii*, and *O. obclavata*.

232 - ***Ganoderma applanatum* (*Polyporaceae*). Injurious to the Oil Palm (*Elaeis guineensis*) in the Island of São-Thomé, Gulf of Guinea.**— MAUBLANC, A and NAVEL, H C, in *L'Agronomie coloniale*, Year IV, No, 30, pp 187-101 + 1 Plate Laval, Paris, 1920.

This disease, characterised by the rotting of the base of the trunk, has spread considerably in the plantations of oil palm (*Elaeis guineensis*) situated in the lowlying parts of the North east region of the Island of São-Thomé. This rotting is followed by the formation of a large cavity occupying as much as a third or half of the base o the trunk, and, especially if the palm has attained a considerable height (10 metres or over) causing its fall after a certain time, without, however altering the appearance of the foliage, or interfering with the production of the fruit until the very last.

The examination of numerous individuals of *E guineensis* has shown that the diseased trees bear on their base, and usually to a height of 1 metre, the fructifications of *Ganoderma applanatum* Pers In the Island of São Thomé, this fungus only attacks the oil-palm, further, it is certain that its presence always precedes the rotting of the trunk. It is therefore reasonable to attribute the disease of the palm to the parasitic polyporacea, and the destructive action of its mycelium upon the tissues of the trunk.

The first precautionary measures necessary to arrest the course of the disease, is to burn all fallen individuals of *Elaeis*. It is also necessary, in plantations, where the disease has been observed, to examine all the palms with great care. The fungus fructifications, and all the diseased tissues should be removed carefully from all the trees attacked, a portion of the healthy part being cut away at the same time After burning the débris, it is advisable to disinfect the wounds, applying, for instance, a concentrated solution of sulphate of iron and to cover them with a coating of tar. It is also advisable to stop up the cavities in the stipe with a resistant substance such as cement, in order to render it more solid and to prevent its breaking.

233 - ***Cucurbitaria naucosa*, an Ascomycete Parasitic on *Ulmus montana* in the Canton of Vaud, Switzerland.** — MORELLON, M., in the *Journal forestier suisse*, Year LXXI, No. 8, pp 155-157, Berne, 1920

At Montcheraud (Canton of Vaud), peculiar swellings appeared in 1912 followed by the withering of the branches upon the upper surfaces of the lower branches of certain elms (*Ulmus montana*) planted in 1902.

This affection was observed every year at the beginning of July, and in that month in 1914, one of the trees lost all its leaves ; it was pruned on the following August 1, and finally died in 1919

The other individuals of *Ulmus montana* withered in a similar manner.

Of recent years, these trees have been visited by a large number of formicides (*Lasius marginatus* or *L. fuliginosus*). In September, 1919, a quantity of dead aphids (*Tetraneura ulma*) were found lying at the foot of one of the elms; the leaves of the tree being covered with galls produced by this insect.

An examination made of the infected branches by Dr. D. CRUCHET during 1919 and 1920, revealed the presence of Sphaeriacea, *Cucurbitaria naucosa*. Fries, and of its metagenetic forms *Diplodia melanea* Lév., and *Camarosporium cruciatum* (Fuckel) Sacc.

A further examination of infected individuals of *U. Montana* led to the discovery in the cankers, and occasionally at the base of the last year's branches, of the scale-insect *Gossyparia ulmi*, whereas the young 1920 shoots were already attacked by *Cuc. naucosa*. It is thus quite clear that the mischief is caused by the fungus. The scale-insects only establish themselves where there is abundant sap, namely where a pad of callus covering a wound is in course of formation.

The only practical way to prevent the spread of the fungus would be to burn the diseased branches, but such a proceeding might lead to the disappearance of a forest tree that is already rare in the district in question.

234 - ***Hypoderma pinicola* and *H. strobilicola*, Discomycetes injurious respectively to *Pinus sylvestris* and *P. Strobus* var. *nana*, in Scotland.** — WILSON, M., in *Transactions of the Royal Scottish Arboricultural Society* Vol. XXXIV, Pt. 2, pp. 222-223 Edinburgh, Nov 1920

Specimens of Scotch fir (*Pinus sylvestris*) showing defoliation and discoloration of the needles, were collected near Dalmally in September, 1920. At the first glance, there was no obvious sign of attack by a fungus, but subsequent investigation has proved that the damage is due to a fungus which has been provisionaly identified as *Hypoderma pinicola*, Brunch. This discomycete was discovered in Norway in 1892 and was later recorded in Denmark and Germany. In the Scottish specimens, brownish or yellowish-grey areas were noticed on the needles, and the abundance of these areas gives the whole shoot a greyish tinge. Examination of the discoloured areas with a lens reveals minute slits in the epidermis from which exude drops of resin. On soaking in water, the slits, which are found in series in both surfaces of the leaf, open widely and reveal the elongated fructifications of the fungus.

BRUNCHORST states that the disease attacks the young neeedles immediately after their development; after one year the discoloration appears, the fructifications of the fungus mature in July and the needles fall in the autumn or winter of the second year. LIND, in Denmark, states that the disease is particularly prevalent during cold and wet summers.

Specimens of the fungus have been collected from other localities in Scotland, and it appears that the disease is widespread; considerable damage is being done by the extensive defoliation of the shoots.

H. strobilicola, Rostr., a closely allied species, was found during April, 1920, at Murthly, causing defoliation of a specimen tree of *Pinus Strobus* var. *nana*. On the Continent this species causes considerable damage to *P. Strobus* but it had not been previously recorded in Scotland.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

235 - **Varieties of *Vigna sinensis* Resistant to *Heterodera radicicola*, in the United States.** — See No 144 of this *Review*.

236 - ***Sesamia nonagrioides*, Macrolepidopteron injurious to the Sugar Cane and Other Gramineae.** — See No 158 of this *Review*.

237 - **Notes on the Coleopteron *Otiorrynchus sulcatus* and the Hymenopteron *Hoplisus laticinctus*, Parasitic on *Begonia tuberosa*, in France.** — FLAMARY, A., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VII, No 2 (Meeting of Jan. 12, 1921), pp. 53-56 Paris, 1921

On May 26, 1919, the author noticed a tuber of *Begonia tuberosa*, grown in a pot, almost completely eaten away internally by about 40 small white larvae. Round the decayed material, he also noticed a number of brown cocoons.

The soil from the pot together with the larvae and cocoons was placed in a glass jar, moistened with rain water, and the jar was covered with fine muslin.

After pupation a number of coleoptera identified as *Otiorrhynchus sulcatus* emerged on June 25.

The females of *Hoplisus laticinctus* emerged from the brown cocoons on June 30, and the males of the same species from July 3 to 7. The number of males was small compared with that of the females.

238 - ***Galerucella nymphaeae* Coleopteron injurious to *Nymphaea advena (Nuphar advena)* in New Jersey.** — WEISS, H. B. and WEST E., in *The Canadian Entomologist*, Vol LII, No. 10, pp. 237-239. London, Oct., 1922.

This species occurs throughout New Jersey on the yellow pond lily *Nymphaea advena* Ait (*Nuphar advena*), which is common along the lower Delaware River and adjacent ditches and tide water streams. During the seasons 1919 and 1920, it was particularly abundant at Monmouth Junction, Westville, and several other places in New Jersey, defacing the leaves and flowers of the last plant.

Notes on the biological formation of the insect are given, drawn for the most part from preceding work on the subject, the description of the egg, larva, pupa and adult has already been made by MACGILLIVRAY and the author here adds further notes.

Preceding investigations have brought into evidence the fact that arsenicals are quite effective remedies in checking this beetle.

239 - ***Silvestrina silvestrii* var. *cecconiana*, n. var. Dipteron Parasitic on Olive Trees in Italy.** — KIEFTER J J, in *Bulletin de la Societe entomologique de France*, No 17, pp. 296-297 Paris, 1920

Systematic description of *Silvestrina silvestrii* var. *cecconiana*. This dipteron has been notified in Italy by Prof. G. CECCONI. This species originates in South Africa and Brazil; it has been obtained from branches of *Morus alba* attacked by *Diaspis* (Capetown and São Paulo) and from fruits of *O. verrucosa* (Natal).

240 - ***Gracilaria perseae* n. sp. Microlepidopteron Injurious to Avocado (*Persea gratissima*) in Florida.** — BUSCK, A, in *The Canadian Entomologist*, Vol LII, No 10, pp 239, fig 1. London, Oct, 1920

Morphological description of the New species *Gracilaria perseae*, bred from leaves of avocado (*Persea gratissima*) at Miami, Florida, during July by G. F. MOZNETTE who states that the species is seriously destructive to the young growth.

The larvae make a small mine between the veins of the young leaves ans subsequently fold the tip or the sides of the leaves downwards. The cocoon is white, narrow, oblong, and is spun in a fold on the leaf of the host plant.

241 - ***Pemphigus populi-transversus*, Aphis Parasitic on the Poplar and on Several Crucifers in New Zealand.** — MILLER, D., in *The New Zealand Journal of Agriculture*, Vol. XXI, No. 3, pp. 134-135, figs 2. Wellington, Sept 20, 1920.

In March 1920, in central Otago, leaves of the poplar were collected with petioles possessing characteristic galls, produced by the aphis *Pemphigus populi-transversus* Riley, a species frequently seen on the poplars in North America.

This insect is interesting from the agricultural standpoint in that it does not confine its attacks solely to poplars; but during migration it is parasitic on the roots of both cultivated, and wild crucifers. It does not usually cause any noticeable damage, but the loss involved may become important if the infested area is extended.

[238-241]

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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

242 - **Antiscorbutic Action of Raw Potatoes, Whether Whole or Crushed** (1). — BEZSSONOFF, in the *Comptes rendus de l'Académie des Sciences*, Vol CLXXII, No 1, pp 92-94 Paris, January 3, 1921

Seeing how important a place is occupied by the potato in the human dietary, the author thought it would be useful to obtain some data as to the content of antiscorbutic principles present in this tuber. To this end, he studied the antiscorbutic effect of raw, unpeeled potatoes upon guinea-pigs fed on oats and water He also compared the antiscorbutic effect of a given quantity of raw, whole potatoes with that of the same amount crushed in a hydraulic press ; the juice and pomace being at once fed to a guinea-pig. He further proposed to determine the antiscorbutic action of these two fractions taken separately.

These experiments showed that the antiscorbutic action of the whole potato (used young, while the pulp is yellow, and before the development of the green cortex) was equal to that of plants with well-marked antiscorbutic properties, such as the cabbage and dandelion

Used in equal quantities, crushed potatoes are much less efficacious than entire tubers

The juice extracted by pressure from raw potatoes has a certain antiscorbutic action, but much less than the same amount of whole, uncrushed tubers.

The pomace alone appears to be almost useless. If the pomace obtained by crushing raw potatoes be added to the juice extracted by the same operation, the antiscorbutic action of the latter is not appreciably increased.

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(1) See *R*, Jan., 1921, No 3 (*Ed*)

243 – **The Theory of Probabilities Applied to Field Experiments.** — I. ROEMER, TH., Ueber die Technik der Feldversuche, in *Fuhlings Landw. Zeitung*, Year 67, Nos 5-6. p 102. Stuttgart 1918; reprinted in *Biedermann's Zentralblatt*, Year, 49, No 5, p. 161, Leipzig, May 1920. — II VATER, H, Ausgleichungsrechnung bei Bodenkulturversuchen (Mitteilung. aus der Kgl Sachs. forstl. Versuchsanstalt zu Tharandt), Berlin, Parey, 1918; reprinted in *Internationale Mitteilungen fur Bodenkunde*, Vol. IX, Nos. 5-6. p. 419. Berlin, 1920. — III. SCHNEIDEVIND, W., MEYER, D, MUNTER, F., Parzellengrössen-Versuche (*Arbeiten der D. L G*, Part 296), pp. 1-51, numerous Plates. Berlin, Parey, 1919. — IV. VAGLER, H., Beziehung zwischen Parzellengrosse und Fehler der Einzelbeobachtung bei Feldversuchen, in the *Journal fur Landwirtschaft*, Vol. 67, p. 97, 1920; reprinted in *Biedermann's Zentralblatt*, Year 49, p. 357, Sept. 1920. — V. RODEWALD, H., Die Mitscherlichsche Ausgleichsrechnung zur Ausschaltung der Ungleicheit des Bodens auf den Versuchsfeldern, in *Fuhlings Landw. Zeitung*, Year, 69, Nos. 19-20, pp. 371-378. October, 1920.

I. TECHNIQUE OF FIELD EXPERIMENTS. — The author attributes great importance to the use of the calculation of the probable error in improving the technique of field experiments. The present technique is not sufficient for the examination of the capacities of numerous varieties, where it is necessary to determine slight differences; in fact, the average error in the field, in the case of fertilisers and varieties, in spite of every care, is from 5 to 7 %, whereas it should not exceed 3 %. Countless mistakes are made even in sowing, and these errors vary according to the character of the seed and the manner of sowing it.

In the case of plots, the experiments of MONTGOMERY, MERCER, HALL, and LARSEN did not give concordant results.

As regards the area of the plots, it was found that the accuracy increased with their size, whereas TOULAIKOV, WOOD and STRATTON were convinced that the error is independent of the size of the plot. But here the question is united to that of the division of the plots into, the different groups composing the "Einzelbeobachtungen" (1). The author believes that when the experiment is repeated on more than 6 plots it does not contribute to any important extent to the accuracy of the "Einzelbeobachtung."

For each of these the error is given by the formula

$$\sqrt{\frac{\Sigma a^2}{n}}$$

where Σ represents the ordinary sign of totalisation, and *a* the elementary errors, that is to say, the differences between the value of the plot and the mean value of the "Einzelbeobachtung," and *n* the number of plots subjected to the "Einzelbeobachtung."

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(1) The "Einzelbeobachtung" (lit. individual observation) includes the data respecting the groups of plots treated alike, or all the values of the plots, each of which is affected by its own elementary error.

After making a comparison between 3 different systems of arranging the plots, each carried out with 12 square plots in one, two, or three regular lines, it was found that the most accurate results were obtained when the plots were arranged in 2 lines only. Repetition contributed more to exactness than did the size of the plots (1).

II. CALCULATION OF THE COMPENSATION IN EXPERIMENTS ON SOIL CULTIVATION. — These experiments bore chiefly on forest trees. The deduction relating to the minimum number of observations necessary for determining a mean error, which is a datum of great importance in estimating the accuracy and the test value, is of paramount importance, both from the forestry and the agricultural standpoint. The author believes that the accuracy of the mean value is proportionate, and depends only on the number of the observations, not on the size of the error of the mean value.

In forestry determinations, a mean value of any real importance must be deduced from at least 50 to 60 individual observations.

III. — EXPERIMENTS ON THE SIZE OF THE PLOTS. — The use of the theory of probabilities in testing the accuracy of field experiments is of quite recent date. The object of the authors is to establish the crops (expressed in terms of a hectare) borne by plots of different sizes and arrangement, and to determine the importance of the application of the theory of probabilities in testing the results of the experiments carried out in the plots when these data have been converted, and expressed in terms of areas that are of appreciable practical size.

The experiments were carried out on a piece of very uniform, flat land belonging to the Station of Lauchstädt; the area of the plots, whether separate or contiguous, was from 200, 100, or 9 sq. m. each, the first being rectangular, and the second and third square. In 1913, sugar-beets were grown in them, in 1914 and 1915, winter wheat was cultivated, in 1916 and 1917, they were under barley. The results were as follows:—

1) The plots separated from one another, in accordance with PFEIFFER's advice, by strips of uncultivated ground, 80 cm. wide, did not yield satisfactory results, either because the yield per hectare was too high (the smaller the plot the higher was this yield), or because the fertiliser, partly owing to the heavy crop, had much less effect.

2) The yield of the contiguous plots of 9, 100 and 200 sq. m. when converted and expressed in terms of a hectare, gave more uniform data, especially when liberally manured, so as to compensate for differences in the soil conditions. The increases in the crops obtained by manuring plots of different size are not such as to guarantee sufficient agreement in the results.

3) The application of a fertiliser to a plot has no particular effect on the contiguous plot, if it is spread in such a manner that its external limit falls within the last line of the plants sown on the manured plot.

4) The differences between the largest and smallest crop for each

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(1) DAY has carried out similar experiments. See *R.*, Sept., 1920, No. 831. (*Ed.*)

group of plots, when expressed in terms of a hectare, vary in inverse proportion to the size of the plots.

The authors subsequently estimate the results from a calculation of the probabilities, subtracting the amount of the probable deviation from the arithmetical mean by employing the formula (1) $\sqrt{\frac{\Sigma^2}{n\,(n-1)}}$ and conclude from this, that:

5) The calculation of the probabilities allows it to be foreseen that the results of the experiments are very certain, expecially in cases where the fertiliser produces large increases in the yield, because these increases usually represent a considerable multiple of the probable error. But in all such cases, the increases are so high and concordant, that there is no doubt as to their accuracy, and it is unnecessary to have recourse to the theory of probabilities. For this reason, the results of experiments should be regarded with suspicion, when a fertiliser produces but light increases in the yield. If in such cases, however, the experiments were repeated on a large number of plots of different dimensions, the incertitude would not be removed, in spite of the calculation of probabilities. The same occurs where experiments are carried out for several years on the same plots. If every year, from the average of the various separate experiments, any effect, however small, is obtained from the application of a nitrogenous fertiliser, this effect must be regarded as real, whatever results may be obtained from the calculation of probabilities.

In spite of the certainty apparently conferred by this theory upon the results obtained from experiments on plots of the same size, the increased crops produced by the fertiliser on plots of various dimensions do not agree sufficiently from many points of view But the calculation of probabilities would not be able to show which data are most accurate, nor whether the variations in yield are due to differences in the character of the soil, or to other causes.

IV. RELATION BETWEEN THE SIZE OF THE PLOTS AND THE ERROR IN THE "EINZELBEOABACHTUNG" IN FIELD EXPERIMENTS. — Experiment plots of 25 sq. m under rye and oats, of 7 5 sq. m. under potatoes, and of 5 sq m. under turnips, and combinations of the same plots, so as to obtain multiples of these areas.

The different results of the experiments gave very irregular variations with the characters of fortuitous errors.

If the size of the plots be brought up to 50 sq. m., the error, in the case of cereals, is considerably reduced.

The true error, as well as the probable error which results from it, decreases with the increase in the size of the plot.

V. MITSCHERLICH'S COMPENSATION CALCULATION FOR THE ELIMINATION OF SOIL DIFFERENCES IN FIELD EXPERIMENTS. — RODEWALD severely criticises the compensation method proposed and adopted by

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(1) See MITSCHERLICH · *Bodenkunde fur Land- und Forstwirte*. Berlin, 1913, p. 304. (*Ed.*)

Mitscherlich is his work entitled "Feldbauversuche mit Kartoffeln" (Field Experiments with potatoes).

Mitscherlich's method is applied to Wagner's quadruple experiment of five-plot manuring, that is to say, to 20 plots that have been subjected to 4 similar experiments with fertilisers of 5 different formulas (1st., no fertiliser, 2nd., K + N, 3rd., K + P, 4th., N + P, 5th. complete fertiliser) (1). Mitscherlich starts from the point that the sum of the crops from the combination of the 5 differently manured plots, no matter where they are taken, must be constant if the soil is uniform. If there is any difference in the figures, this is due to the varying fertility of the soil and the yields must be adjusted to the mean value of this sum, by expressing them in percentage values of the mean value. The author, however, after comparing the data obtained by Mitcherlich's method with those given by the ordinary method of the arithmetical mean, concludes that the former are erroneous, and that the usual method is more suitable for compensation and determining average yields, as well as for calculating errors.

Finally, the author suggests his own method of calculating systematic errors due to variations in soil fertility, taking as his starting-point the following premises: —

1) The observer shall base the calculation on the relative action of the fertiliser and, consequently, express the yield of each plot as a function of the relation between the actual yield on any plot examined and the yield of the unmanured plot, making part of the same fertilising experiment (1st, 2nd, 3rd, or 4th) and taken as a unit of measure.

2) Consider the unfertilised plots as free from error. This, according to the author, is certainly not quite accurate, but the error cannot be estimated by the above-mentioned experimental method. In order to estimate such errors it is necessary to include in the experiment plan from the beginning, at least 2 successive unfertilised plots in every fertilisation experiment, and then to bring up the yield of the fertilised plots to the average of the non fertilised ones of the same experiment.

244 - Practical Universality of Field Heterogeneity as a Factor Influencing Plot Yields.

— Harris, G. A. (Office of Western Irrigation Agriculture, Bureau of Plant Industry, United States Department of Agriculture), in the *Journal of Agricultural Research*, Vol. XIX, No. 7, pp. 279-314. Tables 3, bibliogr. of 22 works. Washington, D. C., July 1, 1920.

The results of studies with reference to the use of modern higher statistical methods in the analysis of data concerning the actual yields of test plots. The particular phase of the problem dealt with is the lack of uniformity of the experimental field, and the author considers it worth while to ascertain to what extent results derived from methods now in use, may be considered reliable.

Heterogeneity is defined as differences in capacity for crop production throughout the field of such a magnitude as to influence in a similar way, but not necessarily to a like degree, the yield of adjacent small plots, and it is pointed out that this factor is measured by a coefficient which shows the degree of correlations between the yields of associated ultimate plots, grouped in combination plots This coefficient has been determined for a relatively large series of experimental fields widely distributed throughout the world, and planted with a considerable variety of crops; the results show that in every field the irregularities of the substratum were sufficient to influence the experimental results, often to a marked extent. The records are in a large part drawn from the writings of those who are recognised authorities in agricultural experimentation, and who have given their assurance of the suitability of the fields upon which the tests were made. Nothing could more emphasise the need of a scientific criterion for substratum homogeneity than the fact that correlations between the yields of adjacent plots ranging from $r = + 0.02$ to $r = + 0.83$, can be deduced from the data of fields which have passed trained eyes as satisfactorily uniform.

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(1) See: Mitscherlich, *loc. cit.*, p. 239. (*Ed.*)

A second phase of this investigation has been to ascertain whether the physical or chemical requisites for plant growth are so distributed over experimental fields thas they may be reasonably looked upon as the source of demonstrated homogeneity in yield. The heterogeneity coefficients for percentage of water content and for chemical composition of the soil were found to be of the same order as those determined for crop yields, and the belief has been expressed that this heterogeneity is directly due to these and other physical and chemical factors. The existence of significant heterogeneity in fields passed by experts as satisfactorily uniform, according to the author, illustrate the inadequacy of personal judgment concerning the uniformily in physical characters or in crop-producing capacity of fields under consideration for experimental work.

This demonstrates the need for greater care in agronomic technique and a more extensive use of the statistical method in the analysis of the data of plot trials, if they are to be of value in the solution of agricultural problems.

CROPS AND CULTIVATION

245 - **Development of Agricultural Meteorology in the United States.** — WARREN SMITH, J., in *Monthly Weather Review*, Vol 48, No. 5, pp. 281-283, bibliogr. of 46 works. Washington, May 1920.

For a considerable number of years now, the problem of Agricultural Meteorology has attracted the attention of American agronomists; in 1806 the Hon. Simeon DE WITT of Albany read a memoir on "Climate and its Relation to Agriculture" before the American Agricultural Society in New York City. In April, 1817, JOSIAH MEIGS, Commissioner of the General Land Office, issued a circular soliciting meteorological records, and in 1819 the Surgeon-General of the army established a system of meteorological observations at the Army posts. This led the Military Academies to interest themselves in the question, thus, in 1825, the regents of the University of the State of New York directed that meteorological observations be made at each of the Academies under their supervision, and, in 1837, the Franklin Institute and the State of Pennsylvania followed the same lines.

The present U. S. Weather Bureau was inaugurated by an act of Congress on February 9, 1870, authorising the Secretary of War to organise a meteorological service throughout the United States.

The Iowa Weather Service, was established in 1875; the Nebraska Service in 1878, the Missouri Service in 1877, and the Ohio Service in 1882.

By 1891 a special weather and crop service was in operation in nearly every State; the publication of Weather and Crop Bulletins was already started in 1887.

On July 1, 1891, all the meteorological work of the Signal Service was transferred to the Department of Agriculture and the present United States Weather Bureau was put into operation. Since this transfer, the work of the Weather Bureau in its relation to Agriculture has developed steadily, and special services have been established for the direct benefit of areas devoted to maize and wheat, cotton, sugar and rice, cattle, tobacco and fruit.

Special forecast and warning services have been inaugurated for tobacco, fruit and truck growers; alfalfa and rice harvesting; fruit spraying, alfalfa seed harvest and sheep shearing etc.

The present Division of Agricultural Meteorology was established as a new division in the Weather Bureau on February 23, 1916. The National Weather and Crop Bulletin has been developed to show the effect weekly upon growing crops, and studies are being made to find the most critical period of growth of the various crops and the weather most affecting them. Detailed temperature and moisture surveys are being carried on in citrus and deciduous orchards to determine the distribution of damaging weather factors, the effect of orchard heating on the temperature, and the part that radiation plays in temperature variations and fruit protection.

Valuable studies in the forecasting of minimum temperatures have been published and equations evaluated from the knowledge of the moisture in the atmosphere in the afternoon and its relation to the temperature variations during the following night (1).

246 - **Apparatus for Protection from Frost in the United States.** — KIMBALL, H. H., and YOUNG, F D, in *Monthly Weather Review*, Vol. 48. No. 8, pp 461-462. Washington, Aug. 1920.

There are 3 quite different types of oil burning heaters in general use on the Pacific Coast.

1) High stack heater, with an abundant draught, resulting in almost complete combustion of the oil, and the formation of only light smoke;

2) Lard-pail heater, with insufficient draft for complete combustion and a dense smoke.

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(1) See *R.* Oct. 1920, No. 950. (*Ed.*)

3) Short-stack heater, intermediate.

Which of these 3 types is to be preferred? The experiments conducted at the Stations of Pomona, Cal. and at Medford, Oreg. are very interesting in this respect. The results obtained may be summarised as follows: —

1) The presence of a dense smoke cloud diminished nocturnal radiation on a average about 0.011 calories per minute per sq. cm. of surface, with maximum effects of nearly 0.030 calories.

2) At a distance of 10 ft., the intensity of radiation from a lard pail heater is about 0.080 calories per minute per sq. cm.; from a short stack, about 0.100 calories; from a high stack, 0.300 calories.

3) Since the intensity of radiation varies inversely as the square of the distance from the source of heat, at a distance of 15 ft. from the heaters it will be less than half at 20 ft. *i. e.* about $^1/_4$ that given above.

4) The heating by radiation is in addition to the heating by conduction and convection of hot air and gases from the burning oil in its immediate vicinity.

It may therefore be concluded that the retardation of nocturnal radiation by the smoke cloud plays an insignificant part in frost protection. The important point is the heat which emanates directly from the radiators; high stack heaters may therefore be recommended. These possess the advantage of avoiding the production of dense smoke clouds which might prove decidedly disagreable is a populated area.

247 - **Evidence of Climatic Effects in the Annual Rings of Trees** (1). — DOUGLASS, A. E. (University of Arizona, Tucson), in *Ecology*, Vol I, No 1, pp 24-32, figs 10, Brooklyn, N. Y Jan 1920

The author presents an entirely new conception towards the relation between climate and tree growth in that it recognises that factors other than seasonal rainfall influence the size of the trees' annual rings.

The information given is in connection with the process of dating and measuring about 85 000 annual rings which had grown in some 275 different trees in the States of Oregon, California, Arizona, Colorado and Vermont, as well as in England, Norway, Sweden, Germany and Bohemia. The climatic evidence is of 3 kinds: — 1) The direct correlation between the annual rings of yellow pine (*Pinus ponderosa*) and the rainfall at Prescott, Arizona; — 2) The marked resemblance found in certain individual rings over a wide extent of the country in which climate is the only common factor; — 3) An extension of the last mentioned evidence but instead of merely taking into account similarities in individual rings, similarity in ring variation over large areas are also considered, by a form of harmonic analysis. The author therefore, constructed an instrument called a periodograph capable of analysing plotted curves into their component cycles, if such exist.

The results obtained with sequoias and yellow pines encourage belief in the reality of this kind of analysis and at the same time to regard climate as a very important if not controlling, factor

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(1) See *R.* Oct-Dec. 1919, No 1081. (*Ed.*)

The author concludes from analyses already made that: 1) Trees probably integrate, and may be made to reveal climatic combinations advantageous to certain types of vegetation; 2) The study of this subject promises to enable the outlining of so-called agro-meteorological districts, that is, areas over which exist similar advantageous combinations of weather elements; 3) The application of the criterion of mean sensitivity promises to make possible the proper selection of sequoia records, which in turn will give much climatic information about the last 3200 years.

248 - **Effect of Heat and Drought on Eucalyptus Plants.** — See No. 303 of this *Review*.

249 - **Humidity and Pore Space, Factors Determining the Adaptibility of the Soil to Tillage.** — ZANDER, H (Landwirtschaftliches Institut der Universitat Königsberg, i. Pr. Abteilung fur Pflanzenbau), in the *Internationale Mitteilungen fur Bodenkunde*, Vol. X, Parts 3-4, pp 79-117, figs 6, Graphs 3, Tables 2. Berlin, 1920.

The greater or less facility with which soil can be worked has been investigated by Messrs MEYER, SCHULLER, HABERLANDT, PUCHNER, VON PIEDZICKI, SCHMERBECK, VÖLCKER, and SPRENGEL, but no practical results were obtained because, according to MITSCHERLICH, this problem, which is of the greatest importance for agriculture, has so far never been studied in a systematic manner, *i. e.* the question of tillage has not been considered as a function of the volume of the pore space in the soil, of the water content, and of the physical condition of the solid soil particles. MITCHERLICH believes that the dynamometer is at present the sole means of determining whether a soil is in a condition to be worked.

The author has tried to determine in the laboratory the laws governing this condition, because only in the laboratory can sources of error be eliminated, and the variable factors isolated.

The apparatus used was MITSCHERLICH'S automatic digger (1) as modified by the author by means of the addition of a closing apparatus at the top with a moveable support regulated by screws, and furnished with a system of wheels round which a rope is wound. The rope is attached on one side to a handle and on the other to the chassis to which the lever percussion-hammer is fixed that hits the handle of the spade in order to drive it into the soil; the height from which the hammer falls, and the number of its blows supply the mechanical force required to make the blade penetrate into the ground, and furnishes an indication of the suitability of the soil for tillage. The apparatus is provided with accessory parts for keeping the hammer vertical and eliminating errors such as friction.

The experiments were carried out by placing the automatic digger on wooden boxes or iron cylinders containing the different soils to be studied, which could easily be weighed and tested; sand, clay, garden-mould, and peat from a " high-moor " (Hochmoor) were used. The soil was first freed from stones, and then pressed down in the boxes or cylinders, moistened, and levelled. The hygroscopicity, moisture, specific and absolute weight, and the volume of the soil were determined each time. By keeping the total pore space constant, and varying the humidity of the soil, the author determined experimentally for each soil some pairs of values relating to the humidity of the soil, and the corresponding mechanical work necessary to drive the spade into it. A being the mechanical work expressed in *erg*, and x the degree of humidity in volume, the author, after deducting the hygroscopic water and observing the course of the curve obtained was able to establish the exponent:—

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(1) Cf. E. A. MITSCHERLICH, *Bodenkunde fur Land- und Forstwirte*. Parey, Berlin, 1913, p. 85. (*Ed.*)

$$A = \frac{a \quad \tau^{\varepsilon}}{c^{hx}}$$

where a and b are constants, log e 0.4343, and ε is the external surface of friction, as long as the humidity of the soil remains below the hygroscopic water, after which, the hygroscopicity being exceeded, the exponent becomes equal to + 1. For a soil with a given pore space, it suffices to determine experimentally a pair of values for two degrees of humidity and the corresponding mechanical work, in order to obtain the constants of the exponent of the water curve (" Wasserkurve ").

The adaptability of the soil to tillage is more affected by the pore space than by moisture. The author, after having also made experiments in this connection with the same apparatus, keeping the humidity constant, and varying x the contraction of the volume of the pores, found that the work of penetration y, and consequently the volumetric curve " Hohlraumvolumenkurve ") may be expressed by the logarithmic function

$$\nu = \frac{a}{k_{\tau}} + r$$

With the help of these two functions, and having already determined by experiment, as has been said, some pairs of values for the water-curve and the volumetric curve, it is possible to calculate tables for each soil. In these tables, the upper horizontal line gives the amount of humidity, the vertical left-hand column indicates, in the same manner, the contraction of the volume of the pores: the mechanical labour corresponding to a given humidity, and to a given size of the volume of the pores will therefore be found, as in the multiplication table, at the vertical and horizontal intersection of the relative lines

On the other hand, once the humidity and the mechanical work are known, these tables can show the volume of the empty spaces, which, according to the author, is a surer and easier method of determining the volume of the pores; he compares it with the earlier methods adopted by TRUKA and KOPECKY, the results of which are very similar (1).

In order still further to demonstrate the accuracy of his method, the author quotes the results obtained by MARQIUS, and finishes by saying that the conclusion resulting from his experiments will be of great importance for practical agriculture, since the least work is needed for tilling the soil when the water present in the ground is not more or less than the hygroscopic water, irrespective of the volume of the pores, and of other physical conditions.

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(1) See *R.*, 1912, No. 1067. (*Ed*)

250 - **The Moisture Equivalent in Relation to the Mechanical Analysis of Soil.** — MIDDLETON, H. E (Soil Physical Investigations, Bureau of Soils, United States Department of Agriculture), in *Soil Science*, Vol. IX, No 2, pp. 159-167. Tables 3, Bibliogr. of 4 works. Baltimore MD., February 1920.

The objects of the present investigation were to determine whether or not the moisture equivalent (1) could be used as a basis to assist in the classifications of soils, and what relation, if any, existed between the moisture equivalent and the mechanical analysis.

The apparatus employed consisted of a metal cylinder attached to the shaft of a vertically mounted electric motor, and holding 16 soil boxes provided with wire gauze bottoms permitting the escape of the excess moisture. A total of 172 duplicate determinations were made on samples from various districts.

From the results obtained, it was evident that the moisture equivalent may not be used as a basis for the classification of soils, but may be of valuable assistance in the interpretation of mechanical analysis. There is a direct relationship between the moisture equivalent and the percentages of sand, silt and clay in the soil as determined by mechanical analysis. This relation may be expressed as:

$$0.063 \text{ sand} + 0.291 \text{ silt} + 0.426 \text{ clay} = \text{moisture equivalent.}$$

The presence of considerable amounts of organic matter in the soil tends to increase the moisture equivalent and to disturb the relation between the mechanical analysis and the said equivalent.

251 - **Effect of Oxidation of Sulphur in Soils (2) on the Solubility of Rock Phosphate and on Nitrification.** — SHEDD, O. M (Chemist, Kentucky Agricultural Experiment Station) in *The Journal of Agricultural Research*. Vol. XVIII, No. 6, pp. 329-345, Tables 14. Bibliogr. of 14 works. Washington, D. C., Dec. 15, 1919.

A continuation of previous work on the sulphur content of Kentucky soils, and the effect of this element and its compounds on plant growth, when it was found that comparatively large amounts of added sulphur are easily oxidised to sulphate in the soil (3). The results also indicated that the sulphuric acid formed would act on rock phosphate when present and convert it into a water soluble form.

The following materials were used in the experiments now undertaken: —

Rock phosphate (Tennessee brown rock) containing 14.2% phosphorus and guaranteed 95 % to pass a 100 mesh sieve; sulphur (ground brimstone or crude sulphur); soil, (fertile bluegrass soil with a high phosphorous content); manure (partly rotted horse manure, fairly free from straw). The starter was simply a mixture of soil, rock phosphate and sulphur, in which the sulphofying organisms were numerous and active. The determinations made included acidity, water-soluble phosphorus, ammonium-citrate soluble phosphorus, total phosphorous, sulphates, nitrites, nitrates, total nitrogen and moisture.

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(1) See *R.*, June 1912, No. 903; *R.*, June 1920, No. 619. Also MOSIER and GUSTAFSON, *Soil Physics and Management*, J. B. LIPPINCOTT Co., Philadelphia, 1917, p. 202; and E. RAMANN, *Bodenkunde*, Berlin, Springer, 1911, p. 336. (*Ed.*)

(2) See *R.*, March, 1918, No. 264. (*Ed.*)

(3) See *R.*, Sept., 1918, No. 961 and *R.*, Jan., 1919, No. 24. (*Ed.*)

After 24 months time, about 17 and 84 % of the total phosphorous had been converted into a water-soluble and ammonium-citrate soluble form, respectively

Sulphurisation did not proceed as rapidly as when the inoculation was made with the sulphofying organism, when the time was reduced nearly one-third.

Composts prepared under the same conditions but omitting the sulphur also showed favourable results in rendering the soil phosphate or that added in rock sulphate soluble, but not to the same extent as when sulphur was present.

Nitrification was found to proceed to a certain extent, regardless of the acid formed by the sulphur oxidation. The amounts of nitrogen found to be nitrified amounted to approximately 20 % of the total originally present.

Experiments were conducted to determine the sulphofying powers of different types of soils which were later used in compost experiments. When 25 and 50 mgm. of sulphur were added to 100 gm. of soil, about the same percentage of the total was oxidised in a given time. In all experiments the barium sulphate was treated with hydrofluoric acid and reprecipitated from sulphuric acid to purify the precipitate

Inoculation of mixtures of rock phosphate and sulphur was not sufficient to promote rapid sulphurisation Soil or soil water were additional necessities. The Fayette County sample showed the highest capacity to render phosphate soluble when mixed with rock phosphate and sulphur. That the production of soluble phosphate was caused by the presence of sulphuric acid generated by the oxidation of the sulphur was demonstrated by the parallel rise in acidity and sulphate.

The author considers that the best conditions to promote the reaction are initial inoculation, high temperature, thorough aeration, and a fair moisture content.

Other contributory factors are the proportions of the different ingredients and probably their mass. Taking into account the cost of materials, the compost consisting of soil, manure, rock phosphate and sulphur appears to be the best, and the presence of some manure and more soil would be advantageous to provide a means of increased bacterial action as well as assisting in the maintenance of the moisture content.

The acid phosphate made by this procedure had just as good a physical condition as the commercial product in spite of the possible objections to time and labour involved. However, as better methods of inoculation are developed, the process may be simplified and it may become of immediate practical benefit.

[251]

252 - **Ammonification of Manure in Soil.** — I. BRIGHT, J. W., What Soil Organisms take part in the Ammonification of Manure. — II. CONN, H. J., Taxonomic Study of two Important Soil Ammonifiers, in the *New York Agricultural Experiment Station, Technical Bulletin*, No. 67, pp. 3-45, Tables 13, Bibliogr. of 43 works. Geneva, N. Y., April 1919.

Former investigators suggest that the spore forming organisms are responsible for soil ammonification (1), but on the basis of the data obtained from the author's experiments, there seems to be good evidence that the rapidly liquefying non-spore formers *Pseudomonas fluorescens* (Flügge) Migrila and *Ps. caudatus*, (Wright) Conn (2) are of primary importance in ammonification in manured soils. The soil used throughout the series of experiments was Dunkirk silty clay loam.

Nearly all the plate counts were checked by direct microscopic examination of soil according to the CONN method (3). In the first place it is clearly demonstrated that the non spore organisms predominate in freshly manured soil to the rate of 99 % of entire flora; this supports the theory upheld by CONN (3).

Secondly, the growth of *Ps. fluorescens* and *Ps. caudatus* compared with the growth of the spore forming *Bacillus cereus*, in sterilised manure soils, gave results indicating that the non spore forming organisms rapidly gain ascendancy over *B. cereus*. The vegetative cells of the latter soon sporulate and remain in resting condition.

All three of these organisms are vigorous ammonifiers when tested in pure culture.

Tables show the relative numbers of organisms, present in the soil, before and after adding manure and the results of inoculating with the 3 organisms separately and in a mixture

Section II gives a detailed description of the characteristics of the non-spore forming Bacteria and discusses the probable relationships of these organisms to others. *Ps. caudatus* is now believed to be identical with *Bacillus caudatus*, Wright 1895, referred to by CONN as the " orange liquefying type " (2).

253 - **Effect of Liming on Acidity in Plant Juices.** — See Nos. 260 and 261 of this *Review*.

254 - **The Duty of Water in Cache Valley, Utah.** — HARRIS F. S., in *Utah Agricultural College Experiment Station Bulletin* No. 173, pp. 2-16 figs. 9, Tables 5. Logan, Utah, March 1920.

A report of experiments on the relation of the amount of irrigation water applied to the yield of crops, including sugar-beets, potatoes, alfalfa, maize, wheat and oats raised on a deep medium soil. The results include a total of 991 tests extending over a period of 17 years. The figures refer to water that actually soaked into the land. In ordinary practice it would be necessary to make allowances for ditch and run-off losses The results can be said to hold good only for soils of the same general type as those on which the experiments were conducted, although they should be useful in estimating the water requirements on other types of soils.

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(1) See *R.* 1918, No. 1334. — (2) See *New York Agricultural Experiment Station, Technical Bulletin*, No. 67. — (3) See *R.* 1918, No. 259. (*Ed.*)

For sugar beets from 15 to 30 inches of water gave the best results. The yield of potatoes was augmented with increased irrigation up to 32 ½ inches, but dropped off rapidly when applications above 60 inches were made. Alfalfa was able to use more water advantageously than any of the other crops. The highest yield was secured with 50 acre inches, although nearly as high with 25 inches. Alfalfa was found to be much less sensitive to over-irrigation than potatoes and sugar beets. From 15 to 22 acre inches of water gave the best results with maize. With wheat, 15 inches of water gave almost as high a yield as any treatment and yet the yield kept up fairly well with the very high irrigations Where no irrigation water was applied, the yields were fairly satisfactory. Oats appeared more sensitive to moisture than wheat. The yields did not differ noticeably for quantities of water between 15 and 45 inches.

The proper diversification of crops made the most efficient use of irrigation water possible.

The proper amount to use must be based on a great variety of physical and economic factors that vary with each set of conditions.

255 - **Electroculture.** — I. MacCrecy R. D., The Theory of Electro Culture. *Scientific American*, Vol. CXX, No. 20, p. 530. New York, 1919. — II Electroculture at Chester. *The Electrical Times*, Vol. LV, p. 205. London, 1919. — III. Blackburn, A. E., Electrochemical Treatment of Seed Grain (Paper read before the British Association for the Advancement of Science, and Discussion), *The Electrical Review*, Vol. LXXXV, pp. 377-379. Id. (1)

I. — When direct current is driven through an electrolyte the negative ions move to the positive electrode and the positively charged ions more to the negative electrode. When alternating current is used this is not the case; the ions move rapidly first in one direction towards one electrode, then in the opposite direction towards the other. They are as it were in a state of intense vibration of an oscillating nature, caused by and in unison with the waves of the alternating current. What then happens if we discharge high frequency electricity through an acre of soil to metallically coated seed, from electrodes (parallel to each other), embedded in the earth?

The earth is in this case the electrolyte, in which, by the action of water, there have been gaseous ions set free. When the electricity is applied, these ions set up an active bombardment on the seeds and tiny roots of the plantlet and since the seeds and roots are porous it must be evident from a mechanical standpoint that some absorption, by the plant, of the gaseous ions takes place. After being absorbed by the plant roots these ions are still subject to the influence of the high frequency electricity which during application, will set up vibrations within the cells of the plant. Such an action will mechanically enlarge the cells in the tissues of the plant and allow it to grow more freely.

The discharge of high frequency electricity through soil is also equivalent to aeration since it causes air to be drawn into the soil with it. This is in a great measure the principal benefit derived from cultivation and is, therefore, an important factor in agriculture because of its stimulation of bacterial action. Moreover the discharge of high frequency electricity through the air combines with the moisture in the soil to produce nitric acid, which contains nitrogen in a form readily available as plant food

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(1) See *R.*, 1919, Nos. 686 and 720. *(Ed.)*

On the other hand the electronic collisions of the ions with alkalies in the earth produce nitrites. The earth in a sense becomes a storage of nitrogen that must be changed by the soil bacteria before it becomes available as plant food. This makes work for the soil-building bacteria. In 1909, Prof. G. E. STONE of the Massachusetts State Agricultural College, proved in a series of tests that by discharging each day a few sparks of static electricity through soil containing bacteria these organisms in 17 days increased 600 per cent. There is another influence of electricity on the bacteria which might be termed bacterial stimulation. Bacteria are sluggish micro-organisms and the galvanic action of the current on their bodies increases their activity.

With the above proven facts in mind, it is not at all surprising that increases in production have been reported where electricity has been properly applied to promote the growth of vegetation.

II — A short note is given of the results obtained from electroculture with electric discharge at Chester. The outstanding fact is that the four varieties of potato that were tried gave decreases. On the other hand, peas, broad beans, French beans, and beetroot gave increased yields of 27,6,8 and 88 per cent. respectively, compared with the control. It is suggested that the bad results were due to the abnormal rainfall when the growth was nearing maturity.

III — Experiments on the electrochemical treatment of seeds are referred to (1) in which the seeds, 10 or 20 sacks, were placed in tanks provided with iron electrodes at both ends; the electrolyte was a solution of sodium nitrate or some other fertiliser. Particularly with cereals (wheat, barley, oats) the yields of both grain and straw are increased. Some 500 farmers have taken up the treatment of the seeds, which is followed by a very careful drying in a kiln and applied a month or two before sowing.

In the discussion A. E. BAINES suggested that a dry seed buried in the soil would become charged in the earth-atmosphere field after the manner of a Leyden jar, when electrodes were applied above and below the seed the current would favour growth of the roots or of the stem according to its direction. BRENCHLEY said that the Rothamsted experiments gave doubtful results; ROSS THOMPSON drew attention to the importance of the nature of the soil; G. H. GARRAD thought that the beneficial effect was not lasting; whilst DUNN and ANDERSON recommended the treatment.

256 - **The Lime Factor in Permanent Soil Improvement. — I. Rotations without Legumes. — II. Rotations with Legumes.** — LIPMAN, J. G. and BLAIR, A W., in *Soil Science*, Vol IX, No. 2, pp. 83-114, tables 17, bibliogr of 8 works. Baltimore M. D, Feb. 1920.

A report of work covering a period of 10 years including the study of the sources of nitrogen, the proper amount to apply, the influence of nitrogen on the yield and composition of the crop, denitrification and other nitrogen losses. On account of the important bearing which the reaction of the soil has on the nitrogen problem, the plan was made to include the use of lime in the carbonate form.

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(1) See *R.* January, 1921, No. 21. (*Ed.*)

I — The soil on which the experiments were conducted contained originally 0.11% nitrogen and 1.22% of total carbon, and no lime had been applied within recent years. The lime treatment consisted of finely ground limestone or oyster shells at the rate of 1 ton per acre just before planting the maize in 1908, and 2 tons per acre again preceding the maize in 1913, the liming thus taking place at intervals of 5 years. A careful record was kept of the amount of nitrogen applied in the form of manure and fertiliser, and likewise of the amount removed by the crops. The 5 year rotation practised was maize, oats, wheat and 2 years of timothy No legume crops were introduced. Twenty plots with different nitrogen treatment were thus limed, and 20 similar plots with parallel nitrogen treatment were left without lime. The total yield of dry matter and of nitrogen for the 10 year period were essentially the same for the 2 sections.

Analysis of the soil made soon after the work was started and again at the end of each 5 year period, showed that there was a loss of nitrogen from both the limed and unlimed sections. However, the loss from the limed section was distinctly more marked.

Results appear to indicate that the practice of using lime on light to medium heavy soils, when leguminous crops are not grown in the rotation, may be questionable. Under such conditions it is quite possible, according to the authors, that a slightly acid reaction may be desirable to prevent the too rapid oxidation of organic matter. On acid peat soils, and poorly drained heavy clay soils, where there is a large amount of oxidisable organic matter, or where oxidation proceeds very slowly, lime may however be used in connection with the growing of non-legume crops to excellent advantage.

II. — An attempt is made to show the influence of lime in 4 different rotation systems, all of which include some legume crops, either as one of the main crops, or as a green manure between the main crops. Two 5 year periods for each rotation were completed. Acid phosphate 300-400 lb., and muriate of potash 100 lb. per acre were applied and light applications of commercial nitrogenous fertilisers were also made. No farmyard manure was used.

During the 10 years the limed plots, with only slight exceptions yielded distinctly larger crops and more nitrogen than the unlimed plots. In most cases, the yields were larger with the 2000 and 4000 lb. applications, than with the 1000 lb. application. There appeared to be a slight difference in favour of the magnesium lime-stone, in preference to the calcium limestone.

The use of lime thus resulted in a gain in both quantity and quality of the crops produced. Analysis of the soil showed that in a number of cases, there was a higher nitrogen content for limed than for unlimed plots ; in other cases, the two were about on a level as to nitrogen content and in a few cases, there was apparently a development of nitrogen in the limed plots.

Compared with the results of the former experiments the authors suggest that in using lime, emphasis should be laid on its power to make conditions favourable for the organisms associated with leguminous crops rather than on its power simply to neutralise soil acids. Its value is more indirect than direct.

257 - **Effect of Manure Sulphur Composts upon the Availability of the Potassium of Greensand** (1). — McCall, A. G. and Smith, A. M., in *Journal of Agricultural Research*, Vol. XIX, No. 6, pp. 239-256, Tables 9, bibliogr. of 13 works. Washington D. C., June 15, 1920.

Report of the results obtained by the Department of Soil Investigations, Maryland Agricultural Experiment Station in connection with experiments on the effect of composting greensand, with sulphur, manure and other materials with a view to making available the potassium contained in the greensand. The samples were taken at intervals, and extracted with distilled water, analysing the water extracts for acidity, sulphate and potassium content.

Two series of composts were investigated, one containing 5.88 % of potassium and the other 1.42 %, in studying the effect of sulphofication upon the solubility of the potassium.

The outstanding results may be summarised as follows:

The composts consisting of greensand, farmyard manure and soil in different proportions showed that an appreciable amount of the potassium of the greensand was made water soluble through sulphofication The composts containing the largest proportion of manure, developed the highest degree of acidity, oxidised the greatest amount of sulphur, and produced the largest quantity of water-soluble potassium. The quantities were smaller in the case of composts in which soil was substituted for a part of the manure. When all the manure was replaced by soil, the rate of sulphofication was so slow that at the end of 23 weeks, only a very small amount of acidity had developed and very little potassium had been made soluble.

The addition of small amounts of ferrous and aluminium sulphates failed to stimulate sulphofication. The addition of 10 gm. of calcium carbonate to the sulphur manure soil compost, had a marked stimulating effect during the early part of the period, but failed to increase the acidity, soluble sulphates, or potassium above the maximum reached by the corresponding compost in which no calcium carbonate was used (2).

With the increase in acidity and the accumulation of sulphur trioxide there was a corresponding increase in the amount of potassium in the water extract. The larger amounts of acidity and soluble sulphate appeared to break down the greensand more rapidly than small quantities. The larger percentage of the total potassium present was liberated in the compost containing the low-potassium greensand.

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(1) See *R.* Jan. 1919, No. 24, and *R.* June 1919, Nos 693 and 694

(2) See *R.* Jan. 1920, No. 18 (*Ed.*)

In the composts containing manure, the total amounts of potassium recovered in the water extracts varied from 9.1 % to a maximum of 41.3 % of the total initial amount present.

Results indicate that the composting of greensand, or of soil rich in potassium, with sulphur and manure, may prove to be a practical and efficient method for obtaining available potassium from comparatively insoluble materials.

258 - **A Survey of the Fertiliser Industry.** — GOLDENWEISER, E. A. (Statistician, Prepared under the Direction of MEIN W. W., Assistant to the Secretary in Charge of Fertiliser Control), in *United States Department of Agriculture Bulletin* Nov. 798, pp. 1-29, fig. 1, map 1, tables XII, bibliogr. of Govt. Publications. Washington, D. C., Oct. 20, 1919.

The U. S. Fertiliser Control, created under authority of the food control act as a war emergency measure in the Department of Agriculture, soon after its establishment, undertook a survey of the Fertilizer industry in order to determine the material used, the products, and the stocks of ingredients and of mixed goods on hand. In view of a serious shortage of several of the materials that enter into the manufacture of fertilisers, it was deemed important to ascertain what the requirements of the industry were, in order to stimulate production of the scarce ingredients, and, if it became necessary, to apportion the available supply of scarce materials on an equitable basis. A series of questionnaires was sent out by the office of Fertilizer Control. The information collected is for the calendar years 1917 and 1918. No comparison with pre-war years can be made, for lack of data, but a future survey of the industry in years after war activities have ceased will afford interesting comparison

Table I shows the amount of materials of different kinds used in the manufacture of mixed fertilisers during the year 1917 and 1918.

The figures for 1918 are not altogether comparable with those for 1917, as 55 companies included in the tabulation for 1917 and for the first six months of 1918 failed to make reports for the last six months of 1918. In the case of acid phosphate an estimate has been made to cover the companies for which reports were not received for July to December, 1918.

Table II shows the quantity of materials used in the manufacture of acid phosphate during 1917 and the first 6 months of 1918.

The production of phosphate rock is conducted by a number of fertiliser companies and by other producers, mostly in Florida. Many of the great fertiliser companies are interested in the phosphate fields and are producing their own rock.

Table III shows the sources of nitroger (ammoniac) used in mixed fertilisers. The principal source of nitrogen is sodium nitrate, the second

TABLE I. (2000 lb. tons).

Kind of material	1917	1918
Agricultural lime	32 602	40 252
Agricultural salt	2 474	2 650
Acid phosphate	3 746 693	* 3 554 000
Potassium sulphate	13 420	16 808
Potassium muriate	12 124	19 189
Potassium nitrate	14 478	17 286
Potassium carbonate	7 656	5 706
Kainite	2 175	368
Manure salts	1 684	194
Nebraska potash	7 201	18 815
Cement dust	6 489	6 301
Furnace dust	8 499	12 105
Roasted alunite	667	1 999
Kelp (dried)	3 064	4 777
Kelp (ash)	2 929	3 722
Kelp (char)	16	348
Tobacco waste	37 218	30 816
Wood ash and other plant ash	6 593	7 458
Manure ash	2 197	2 768
Feldspar	601	134
Sugar factory waste	5 071	5 250
Other potash materials	33 863	34 898
Sodium nitrate	285 983	234 794
Ammonium sulphate	125 283	103 356
Cyanamid	37 230	6 099
Nitrate of lime	33	595
Ammonium phosphate	20 237	7 096
Animal tankage (high grade)	185 491	134 446
Animal tankage (low grade)	108 775	82 209
Garbage tankage	123 835	96 142
Tankage (n. o. s.)	5 994	4 770
Dried blood	37 189	25 799
Cottonseed meal	306 399	273 876
Fish scrap (dried)	28 769	28 813
Fish scrap (acidulated)	17 234	24 215
Castor bean pomace	19 948	36 481
Hair	9 254	7 179
Hoof meal	6 340	5 681
Horns	200	74
Hide scrap	218	921
Leather scrap or meal	18 078	13 892
Leather (acidulated)	75	
Wool waste	1 135	1 002
Tartar pomace	2 709	2 893
Peat (dried)	742	1 892
Natural guano	67 715	52 549
Base goods	518 378	502 132
Other nitrogenous materials	39 162	29 259
Filler	161 932	216 764
Other materials	6 986	11 294

(*) Partly estimated.

source is ammonium sulphate; among the organic sources of ammonia, tankage and cottonseed meal are by far the most important.

TABLE II. (2000 lb. tons).

Material	1917	January to June inclusive, 1918
Phosphate rock	2 206 523	1 172 124
Steamed ground bone	71 925	33 196
Raw ground bone	31 657	22 667
Bone black	986	600
Basic slag	128	77
Other phosphatic materials	484	326
Sulphuric acid	2 135 113	1 068 464

TABLE III.

Material	Percentage of ammonia from each source	
	1917	1918
Sodium nitrate	28.9	29.4
Ammonium sulphate	16.3	16.7
Cyanamid	3.1	0.6
Nitrate of lime	—	0.1
Ammonium phosphate	1.4	0.6
Tankage: Animal (high grade)	11.0	9.8
» Animal (low grade)	4.1	3.8
Garbage	2.2	2.1
n. o.	0.2	0.2
Dried bloods	2.8	2.4
Cottonseed meal	13.8	15.3
Fish scrap (dried)	1.4	1.7
(acidulated)	0.6	1.0
Castor bean pomace	0.7	1.6
Hair	0.9	0.9
Hoof meal	0.5	0.6
Horns		
Hide scrap		0.1
Acidulated leather		
Leather scrap or meal	1.3	
Wool waste		
Tartar pomace		
Peat (dried)		
Natural guano	2.8	2.7
Base goods	6.7	8.0
Other nitrogenous materials	1.3	1.2
	100.0	100.0

The total amount of nitrogen calculated as ammonia used during 1917 was more than 18 600 000 units of 20 lb., and the total amount used during 1918 exceeded 15 000 000 units. Base goods is a name by which the companies call preliminary mixtures, that are stored in large bins against the time when orders need to be filled and the base goods are mixed with the other ingredients to obtain a desired grade of goods.

A special enquiry was made for tankage and table IV shows the total quantity of tankage and allied materials produced in 1917 and 1918 and marketed in 1918.

TABLE IV.

Kind of material	Production 503 firms reporting (2000 pound t,		Quantity marked in 1918. 386 firms reporting (2000 pound tons)				Percentage marketed 1918		
	1917	1918	Total	As fertiliser	As feed.	For other purposes	As fertiliser	As feed.	For other purposes
Animal tankage (high grade)	157 300	185.839	182 320	103 703	78 187	430	56.9	42.9	0.2
Animal tankage (low grade)	59 604	64 614	62 805	56 239	5 213	1 354	89.5	8.3	2.2
Concentrated tankage	24 674	25 490	26 098	16 540	9 481	77	63.4	36.3	0.3
Garbage tankage	36 997	34 718	28 598	28 598	—	—	100.0	—	—
Tankage	7 750	10 004	3 732	3 122	58	552	83.7	1.6	14.7
Dried blood	32 007	35 463	32 578	26 918	5 671	—	83.6	1.5	14.9
Raw bones	27 981	33 644	26 451	22 607	3 281	862	82.6	17.4	—
Dried bones	24 348	21 475	20 158	20 093	5	60	85.5	12.3	3.2
Hair	5 617	8 754	4 638	1 941	—	2 698	41.8	—	58.2
Hoofs and horns	6 715	4 671	4 008	3 539	386	83	88.3	9.6	2.1
Meat scrap	3 265	3 233	3 561	—	3 549	11	—	99.7	0.3

In connection with cottonseed meal an enquiry was made from all the mills that manufacture cottonseed oil and meal as to the amount produced during the fiscal year July 1, 1917, to June 3, 1918, and the amount disposed of for different purposes and different ways. In the aggregate, two thirds of the cottonseed meal was used as feed and one-third as fertiliser, with however, considerable variation in this respect between the different States (See Table V.)

In pre-war years the United States consumed yearly about 250 000 tons of potash, practically all of which was imported from Germany. When the German supply was cut off in 1914, the United States turned its attention to domestic production, which has increased to 53 000 tons in 1918, about one-fifth of the annual pre-war consumption. Some crops probably have suffered during this period from a lack of potash, but the main needs were supplied. The price of potash rose from between 75 cents and $1 a unit to between $4 and $5 a unit, and with this great increase in price the domestic manufacturers entered the field of production. Whether the American potash industry will be able to survive under normal conditions is an open question.

TABLE V. Amounts in 2000 pound tons.

State	Number of mills reporting	Total tons of cottonseed meal and cake produced	Quantity used by mills in the manufacture of fertilizer	Quantity sold to farmers to be used as		Quantity shipped to other points' to be used as		Undistributed	Percentages						
									Used by mills in the manufacture of fertilizer.	Sold to farmers to be used as		Shipped to other points to be used as		Total percentage used as	
				feed	fertilizer	feed	fertilizer			feed	fertilizer	feed	fertilizer	feed	fertilizer
Alabama . . .	41	78 352	4 738	8 107	6 210	26 645	12 424	20 228	8.2	13.9	10.7	45.8	21.4	59.7	40.3
Arizona . . .	3	6 597	—	2 406	—	4 191	—	—	—	36.5	—	63.5	—	100.0	—
Arkansas . . .	32	137 633	3 226	14 510	3 305	104 690	8 614	3 288	2.4	10.8	2.5	77.9	6.4	88.7	11.3
California. . .	1	7 327	—	—	—	7 327	—	—	—	—	—	100.0	—	100.0	—
Florida . . .	3	6 692	—	160	440	4 025	2 067	—	—	2.4	6.6	60,1	30.9	62.5	37.5
Georgia. . . .	107	346 603	26 691	29 879	52 781	114 786	71 638	53 828	8.1	10.2	18.0	39.2	24.5	49.4	50.6
Illinois. . . .	1	3 781	—	300	—	3 481	—	—	—	7.9	—	92.1	—	100.0	—
Kentucky. . .	1	5 173	—	1 000	—	3 773	400	—	—	19.3	—	73.0	7.7	92.3	7.7
Louisiana. . .	25	140 434	427	9 490	8 224	80 671	41 622	—	0.3	6.8	5.9	57.4	29.6	64.2	35.8
Mississippi . .	48	214 715	6 917	16 718	9 210	140 023	18 841	23 006	3.6	8.7	4.8	73.1	9.8	81.8	18.2
Missouri . . .	3	20 130	—	1 080	—	19 050	—	—	—	5.4	—	94.6	—	100.0	—
North Carolina	57	129 466	13 049	13 024	42 251	11 985	40 683	8 474	10.8	10,8	34.9	9.9	33.6	20.7	79.3
Oklahoma . .	48	141 282	1 098	43 910	2 080	94 194	—	—	0.8	31.0	1.5	66.7	—	97.7	2.3
South Carolina	75	161 804	9 409	21 748	71 230	15 565	43 852	—	5.8	13.5	44.0	9.6	27.1	23.1	76.9
Tennessee. . .	20	105 368	—	2 540	4 378	62 199	3 484	32 676	—	3.5	6.0	85.7	4.8	89.2	10.8
Texas	41	111 260	101	22 080	796	63 976	—	24 307	0.1	25.4	0.9	73.6	—	99.0	1.0
Total for 16 *States* . . .	**506**	**1 616 617**	**65 656**	**186 952**	**200 905**	**756 581**	**243 625**	**165 807**	4.3	12.9	13.8	52.2	16.8	65.1	34.6

Finally table VI shows the production of mixed fertilizer andmaterials sold as such during 1917 and 1918.

TABLE VI.

2 000 lb. tons.

Kind of material	1917	1918
	tons.	
Mixed fertilizer produced	4 442 528	4 957 799
Materials sold as such:		
Acid phosphate	2 097 232	2 024 574
Phosphate rock	393	542
Bones: Raw bones	10 023	7 532
Steamed bones	698	3 249
Raw bone meal	11 379	15 707
Steamed bone meal	683	1 336
Tankage	8 114	37 827
Blood	3 126	2 304
Fish scrap	1 749	1 889
Cottonseed meal	6 682	7 987
Natural guano	1 152	6 266
Nitrate of soda	7 241	11 334
Ammonium sulphate	531	2 334
Cyanamid	117	4

Of the 2 000 000 tons of acid phosphate reported sold as such, a considerable quantity was sold to dry mixers who used it in preparing the final product. The quantity of acid phosphate used by dry mixers in 1917 was 494 261 tons, leaving about 1 50 0000 tons of acid phosphate sold for direct application to the soil. Certain quantities of bone, tankage, blood, fish scrap, and cottonseed meal were sold in their original state; also some nitrate of soda, but beginning with July, 1918, practically no nitrate of soda was sold as such.

259 - **Variation in Sexuality, Dioecism and Sexual Dimorphism of *Pinus montana* and *P. sylvestris*.** — GUINIER, P., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 2, pp. 94-96. Paris, Jan. 15, 1921.

Under normal conditions, the various species of the genus *Pinus* are monoecious, both male and female inflorescences being evident on the new shoots even at the beginning of their growth. The fruiting branches or catkins, develop in the axil of the involucre inserted at the base of the shoots and are short, modified branches generally, and invariably with *Pinus sylvestris* L. and *P. montana* Mill., the fertilised female inflorescences are borne only at the apex of the shoots, on a level with buds arranged in a false whorl, which, the following season, will produce lateral branches, whilst these fertile branches, in the course of natural growth, will be transformed into cones. The female branches have therefore the morphological value of long branches that develop sooner.

The distribution of the two types of inflorescences is clearly relative to the vegetative vigour of the branches bearing them. The catkins, always much the most numerous, are distributed indiscriminately over the tree, existing, however, only on the less vigorous parts, such as at the base of the branches, and generally below the apex. The less common female fruiting branches are found only at the apex of the vigorous branches, especially on the highest branches. Usually, the spurs bearing female inflorescence also possess catkins at the base; however, some shoots bear only a male inflorescence.

In *P. montana* and also with *P. sylvestris* a tendency has been observed towards dioecism, or, more accurately, a sort of polyoecism, which is evinced by the existence of a number of male plants by the side of monoecious plants. NORDLINGER has observed the fairly frequent dioecism associated with *P. montana* and, more recently, SCHRÖTER has remarked on the same fact in Switzerland.

Similar observations have been made regarding the northern type *P. sylvestris* var. *lapponica* by Scandinadian workers. The author has observed that, in the vast forest of *P. montana* sub sp. *uncinata* Ramond in the Capcir region in the Montlouis district (E. Pyrenees), this Pyrenean type presents the same peculiarity and amongst a big group of trees comparatively rich in female inflorescences, certain trees bear males only.

Dioecism, in the case of pines, is accompanied by a certain sexual dimorphism. On a normal monoecious tree., the branches terminating in male inflorescences present distinct morphological differences. On the less vigorous branches arising each year from a minor quantity of male inflorescences, the catkins are distributed over the major part of the new shoots, and only a small area is left at the apex for the short leaf-bearing twigs. After the catkins have fallen, a long bare strip is left at the base of each new shoot, whilst the leaves form a collar at the top of the shoots. Quite different is the appearance of the vigorous branches terminated by female inflorescences. These branches are of considerable length and the shoots are almost entirely covered with leaves. At the base of each shoot, there is a short defoliated area which may be attributed either to the fall of the catkins or to the normal absence of twigs at the axil of the lowest leaf scales. As regards the males, all the branches belong to the first type described: some botanists have compared them to the stems of *Equisetum* on account of the apparently whorled arrangement of the leaves. BEISSNER with reference to male individuals of *P. montana* and BENVALL to males of *P. sylvestris* var. *lapponica* have established a new form, namely *equisetiformis*. BEISSNER even considered that it constituted a genuine variety; SCHRÖTER and VON TUBEUF have established the real cause of the morphological peculiarity observed.

The author has also observed that certain peculiarities are noticeable amongst a group of *P. montana* subsp. *uncinata* in the Pyreneees. The Pyrenean type is characterised, amongst other things, by its slender habit, a compact conical crown, with rigid branches, curved from the base upwards. On the other hand the males have wider spread branches, more or less intertwined, less abundant foliage and a more irregular and spreading crown.

SCHRÖTER had previously drawn attention to the fact that the males possessed a more open branching system. This difference can only be attributed to less vitality and to the slower growth of the male branches, as a whole.

Occasional cases of dioecism with *P. montana* are considered by the authors to be due to individual peculiarities. The phenomenon, is apparently influenced by physiological conditions which cause variations in individual vitality particularly with reference to age and to vegetative conditions. RENVALL has shown that with *P. sylvestris* var. *lapponica*, although the young trees always possess female inflorescences, the other trees tend to produce an ever increasing proportion of males and,consequently, no cones, and that trees growing on poor soil behave similarly. In the Eastern Pyrenees, the males of *P. montana* subsp. *uncinata* in question (all of a fairly advanced age) were growing on soil of mediocre fertility; the foresters have however, observed that, in that district, the older trees produce but little seed.

Sexuality in *P. montana* and *P. sylvestris*, depends therefore on the development of the vegetative apparatus; the production of female inflorescences necessitates a certain vitality of the shoots, whilst with retarded growth only males are formed. The variations in sexuality can thus be explained, and also to a certain extent the tendency to dioecism. The morphological peculiarities of both male or female spurs, which lead in the most accentuated cases to sexual dimorphism for male individuals are only the consequence of these facts.

260 - **Studies on the Reaction of Plant Juices.** — HAAS, A. R C. (Departments of Agricultural Bacteriology and Soils, University of Wisconsin), in *Soil Science*, Vol. IX, No. 5. pp. 341-368, pl. 1. figs. 11, bibliogr. of 18 works. Baltimore, M. D., May 1920.

The investigations made by the author deal with the actual and total acidities (1) and the total alkalinity of the juices of a number of plants of agricultural importance, together with a study of the influence of liming the soil upon these acidities. The effect of age, lack of chlorophyll and changes in illumination upon the actual and total acidities of plant juice are also considered. These determinations were made by the use of the hydrogen electrode. The plants employed included clover, serradella, garden beans, barley, oats, maize, alfalfa, field peas, lupin, mustard, timothy, wheat and buckwheat.

The most noticeable difference in the actual acidity of the juice from plant on limed and unlimed soil was with the buckwheat seedlings., *i. e.*, pH = 5.48 to 5.97 respectively (p = index of acidity in a solution), whereas in the mature conditions a reaction of pH = 4.82 was reached. Apparently the degree of maturity of a plant seems to be an important factor in the degree of actual acidity attained. The general results with all the plants used in this experiment indicate that the actual reaction of the juice of many agricultural crops is distinctly acid.

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(1) Actual acidity indicates amount of dissociated acid Total acidity includes both dissociated and undissociated acids. (*Author's Note*)

The alkali reserve (1) of the roots of medium red clover and of sweet clover, according to the determinations made, is less than that of the leaves, even though the actual acidity of the roots is greater than that of the leaves. The results from the two species may therefore serve as a rough comparison of the relative amounts of carbonates and bicarbonates in the juice of the 2 species. The unique case of a single plant having juice with a markedly alkaline actual reaction and a steep gradient in actual reaction is reported.

The observations made up to the present time with regard to the total acidity, appear to show that this tends to fluctuate in the same direction as the actual acidity, with exceptions. The juice of the younger portions of a plant usually show a lower actual acidity than the older portions.

A preliminary experiment was made with maize seedlings, and the total acidity of the juice of seedlings lacking chlorophyll was less than that of tops containing chlorophyll until about pH = 8.6 was passed, after which conditions were reversed.

The effect of light on the reaction of the juices, showed that both actual and total acidity decreased with a reduction of normal illumination.

The author considers that these results support the suggestion made by TRUOG that the main specific harmful influence of soil acidity on certain plants is due to its influence in preventing the plants from securing sufficiently rapidly the bases that are needed to neutralise and precipitate acids within the plant.

261 – **Acidity of Buried Herbaceous Plants and the Lime Soil.**— MASONI, G (Istituto di Chimica agraria della R. Università di Pisa), in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, Part 12, pp. 421-437. Modena, 1920.

The author observed in 1914, that on mixing the sap of young maize plants with calcareous soil and an excess of calcium carbonate, the sap retained its acid reaction even after 4 or 5 days and only acquired a neutral and then alkaline reaction after putrefaction. On account of the interest of this fact in relation to the burying of green herbage and as regards the investigation of the acids in fresh and in decomposing vegetable matter, the author has taken up this study with the aid of a series of experiments, which have led to the following conclusions :

Acid saps of young herbaceous plants (maize, lucerne, and beet) when placed in contact with calcareous soil and even with pure calcium carbonate (precipitated), the carbonates being greatly in excess of the acids, retained their acid reaction for several days. This also occurs with saps tested immediately after extraction as well as with saps in which acid fermentation had taken place.

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(1) Alkali reserve equals the change in the actual reaction of the juice upon the addition of acid. (*Author's Note*).

Total or partial sterilisation retarded the neutralisation of the free acids in contact with the lime which coincides very often with the putrefaction of the saps.

When fresh or fermented saps were heated to boiling point with calcareous soils or pure calcium carbonate a distinct acidity was maintained when soils were used, and this acidity persisted for several days. With pure calcium carbonate there was an appreciable decrease in acidity, but it was not completely neutralised, except in the case of fresh beet sap.

Solutions of numerous acids and organic acid salts of different concentrations and presenting degrees of acidity and corresponding approximately to the acidity found in the saps (expressed in terms of normal alkali), were quickly neutralised on contact with the calcareous soils and with pure calcium carbonate, either in the cold or after boiling.

On the contrary, solutions of monopotassium phosphate and monocalcium phosphate in concentrations corresponding to those precipitated, retained, when in contact with the same soils, an acid reaction for several days either in the cold or after boiling in contact with pure calcium carbonate; in the cold, they were neutralised more quickly, and very rapidly after boiling.

The proteins, starches and sugars present in the sap, do not impede the reaction between the acids and the lime.

The lime in the soil does not neutralise either the congenital acidity of the plants or their fermentation products. The author estimates that the permanence of the acidity of vegetable saps is due to the fact that the acid phosphates of alkali metals and alkali earths resist, under similar conditions, saturation by the lime in the soil, and also because there is less monopotassium phosphate in the sap.

As regards green manure, the lime in the soil has but a secondary action in neutralising the acidity of the buried plants, that is to say, only to such an extent as to favour putrefaction with the resulting formation of basic substances.

In the first phase of the green manure, the acidity of the sap, even in the presence of lime, is increased by fermentation, especially of the sugars. It is known that green manure aids the dissolution of the mineral matter in the earth ; these experiments show that this dissolution is not due to the acidity of the plants.

262 – **Research on the Diffusion of Sulphocyanic Acid in Plants.** — DEZANI, S. (Laboratorio di materia medica e Jatiochimica, Turin), in *Le Stazioni sperimentali agrarie italiane*, Vol LIII, Part 1, pp 438-440, bibliography of 6 works Modena, 1920.

The results of the author's researches are summarised in the appended table. The — sign indicates that the classic reactions for sulphocyanic acid (with chloride of iron, copper sulphate, calomel, hydrogen peroxide, and chloride of iron), gave negative results. A single + sign indicates that the reaction was slightly positive, and + + intensely positive.

The table shows that, of the plants examined, the Cruciferae were the only ones which contained sulphocyanic acid, and that this compound is widespread in this family.

The author has found that hay contains this acid in proportion to the quantity of Cruciferae it holds. It is probable that this acid is a direct product of the cellular metabolism of the Cruciferae and is not produced through the decomposition of the esters of isosulphocyanic acid, nor is it derived from enzyme action which take place after the death of the plant.

	Botanical family	Organs used	Quantities in gm,	Result of the reactions
Allium Cepa L.	Liliaceae	Bulbs	500	—
Brassica Rapa L.	Cruciferae	Roots and leaves	500	++
Bunias Erucago L.	Cruciferae	Herb	750	+
Calepina Corvini Desv.	Cruciferae	Herb	650	—
Castanea vesca Gaertn.	Cupiliferae	Seeds	500	—
Cichorium Endivia L.	Compositae	Leaves	500	—
Cochlearia Armoracia L.	Cruciferae	Roots	250	++
Daucus Carota L.	Umbelliferae	Roots and leaves	500	—
Eruca sativa Mill.	Cruciferae	Herb	700	+
Nasturtium officinale R. Br.	Cruciferae	Herb	720	++
Phaseolus vulgaris L.	Leguminosae	Seeds	500	—
Pyrus Malus L.	Rosaceae	Fruit	500	—
Pisum sativum	Leguminosae	Seeds	500	—
Raphanus Raphanistrum L.	Cruciferae	Herb	800	+
» *sativus*	Cruciferae	Roots and leaves	250	++
Sinapis alba L.	Cruciferae	Herb	600	++
» *arvensis* L.	Cruciferae	Herb	850	++
» *nigra* L.	Cruciferae	Herb	800	++
Sisymbrium Alliaria Scop.	Cruciferae	Herb	800	+
» *officinale* Scop	Cruciferae	Herb	600	++
Spinacia oleracea L.	Chenopodiaceae	Leaves	500	—
Thlaspi Bursa-pastoris L.	Cruciferae	Herb	800	—
Triticum sativum Lmk.	Graminaceae	Fruit	700	—

263 – **Some Proteins from the Georgia Velvet Bean *Stizolobium Deeringianum* and the Mungo Bean (*Phaseolus aureus* Roxburgh).** — JOHNS, C. O. and WATERMAN, H. C., in *The Journal of Biological Chemistry*, Vol. XLII, No. 1, pp. 59-69, Tables X; Vol. XLIV, No 2, pp. 303-317, Tables IX. Baltimore, May and Nov. 1920.

I. — The Georgia velvet bean is a sport of the Florida velvet bean, *Stizolobium Deeringianium*, from which it differs principally in having the shortest season of all the cultivated *Stizolobia*, and so can be successfully grown in the extreme northern part of the cotton belt. An examination of the closely related Chinese velvet bean, *Stizolobium niveum* has already been made (1).

The bean in question was found by the authors to contain 23.6 % of protein (N × 6.25), and 3 % sodium chloride solutions extracted a maximum of about 15 % protein from the finely ground seed. A yield of 13 % of mixed proteins is stated to be obtainable by coagulation from the slightly acidified extract at the boiling temperature. By the fractional precipitation of the extract with ammonium sulphate, however, and by subsequent purification of the fractions, two globulins, designated α- and β-globulins, were separated, in yields of about 3 and 1.25 %, respectively. The former contained 90 % of sulphur and coagulated at 70-78° C., and the latter 45 % of sulphur with coagulation at 90-100° C. An albumin was found in extracts freed from globulin by repeated dialysis. The latter protein coagulated in yields of about 75 % by the prolonged heating of its slightly acidified solution at 65° C. Analysis of the three proteins obtained by this method, showed marked differences in the nitrogen and sulphur content, and in the distribution of nitrogen as determined by VAN SLYKE'S method (*Journal of Biological Chemistry*, Vol. x, 1911-12, No. 15).

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(1) See *R.* Sept. 1918, No. 965. (*Ed.*)

Qualitative examination indicated that the β-globulin contained no tryptophane, an observation of particular interest in view of the fact that this amino-acid had been found to be present in all seed globulins heretofore tested. The α-globulin and the albumin from the Georgia velvet bean both contain tryptophane.

II. — The mungo bean or green gram is cultivated throughout the southern half of Asia, especially in India; in the Malay Islands, and quite generally throughout the eastern portion of Africa, and with a certain degree of success also in mid and southern United States.

The protein content was found to be about 21.74 % (N × 6.25). A series of experiments made with aqueous solutions of sodium chloride indicated 5 % as the most effective concentration of this salt for extraction purposes. From the finely ground seed, 20 volumes of 5 % sodium chloride solution dissolved about 19 % of protein, calculated on the dry weight of the meal used, or 87.5 % of the total protein. The coagulation points in the above mentioned extract and their precipitation limits with ammonium sulphate were next determined. A very low coagulation point (about 40°C), together with two others at higher temperatures indicated an albumin and two globulin fractions, the first precipitated at from 0.15 to 0.20 of saturation and the second at 0 65. The procedure of the fractionation of the globulins was essentially the same as that used in isolating the globulins of the Georgia velvet bean. The yields were 0.35 and 3.75 for α- and β- respectively, computed on the basis of the dry material extracted. Traces of albumin were also obtained from extracts from which all the globulin had been precipitated by prolonged and repeated dialysis. The albumin remained in solution during the dialysis, and was separated by slightly acidifying and coagulating at 45° C. The yield of the albumin was from 0.02 to 0.05 % of the weight of the bean meal.

Analysis showed marked differences in the nitrogen and elementary composition of the 3 proteins. The globulins were still further distinguished from each other by marked differences in their percentage of the basic amino-acids, determined by the VAN SLYKE method. The β-globulin contained so little cystine that, remaining undecomposed after hydrolysis it escaped precipitation by phosphotungstic acid and the said method was therefore impracticable in this case.

264 - **Protein Investigations with the Coconut — I. Some Amino-Acids from the Globulin as Determined by the Butyl Alcohol Extraction Method of** DAKIN. — **II. Hydrolysis of the Globulin of *Cocos Nucifera*** — JOHNS, C. O., and JONES, D. B. (Bureau of Chemistry. United States Department of Agriculture, Washington), in *The Journal of Biological Chemistry*, Vol. XLIV, No 2, pp. 283-301, Bibliogr. of 12 works Baltimore, May and Nov. 1920.

I. — A determination of the amino-acids which remain in the aqueous solution of the hydrolysis products of coconut globulin after it has been subjected to extraction with normal butyl alcohol according to the DAKIN method (*The Biochemical Journal*, 1918, Vol. XII, p. 290). By this method practically the whole of the di-basic acids and the diamino-acids are contained in the aqueous solution. Glycine and serine are also only extracted with difficulty. The coconut globulin used for this hydrolysis was prepared as described in the JOHNS, FINKS and GERSDORFF experiments (1) Attention was confined chiefly to the amino-acids remaining in the aqueous solution after the extraction.

The following values were found: glutaminic acid, 19.07 %, aspartic acid, 5.12 %, alanine, 2.76 %, and serine 1.76 %. No hydroxyglutaminic acid or glycine could be detected. From the amino-acids extracted by the butyl alcohols, 5.4 % proline, and 0.64 % of leucylvaline anhydride were isolated.

II. — A complete determination of the degradation products was made according to methods not involving extraction with butyl alcohol. The authors were able to give percentages of those amino-acids which had not been determined in the previous hydrolysis, and also to furnish supplementary data for comparison with those already obtained.

78.15 % of the hydrolysis products of the protein used, was identified and determined. The following gives the amino-acid content in coconut globulin to the highest value obtained % :—

Glycine-trace — alanine 4.11 — valine 3.57 — leucine 5.96, — proline 5.54 — phenylaline 5.54 — aspartic acid 2.05 — glutaminic acid 19 07 — hydroxyglutaminic acid 0.00 — serine 1.76 — tyrosine 3.18 — cystine 1.44 — arginine 15.92 — histidine 2.42 — lysine 5.80 — tryptophane present — leucylvaline anhydride 0.64 — ammonia 1.57.

265 - **Action of Chloropicrin on the Germination Power of Seed** (2). — MIÈGE, E., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 3, pp. 170-173 Paris, Jan. 17, 1921.

Various workers have shown that chloropicrin is a powerful insecticide which is effective for the destruction of certain parasites. The action of chloropicrin on the germination power and the cultural value of seeds, however, remained to be determined.

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(1) See *R.* April 1919, No. 439. (*Ed.*)

(2) See *R*, July-Sept, 1919, Nos 1049-1050; *R.* Jan., 1920, Nos. 6 and 148; *R.*, Feb. 1920, No. 274; *R.* Mar., 1920, Nos. 374 and 378; *R*, May, 1920, No 595; *R.*, June, 1920, No. 705

In a previous experiment on a large scale several quintals of different infested seeds (pea, bean, wheat, etc.) were treated, either by watering the closed sacks, in the way indicated by M. G. BERTRAND, or by placing the chloropicrin in vessels placed close to them. With a dose of 20 cc per cubic metre of space, or per sack of about 80 kg. the pea-weevil (*Bruchus pisi*), bean-weevil (*Br. obtectus*) and the grain-weevil (*Calandra granaria*) were, in both cases, radically destroyed within 24 hours without any apparent harm to the germination power. The wheat alucide (*Sitotroga cerealella*) was also completely destroyed under similar conditions.

In a second series of experiments in the laboratory, samples of seeds of various cultivated plants were placed in dishes under a bell-jar and treated for varying periods with chloropicrin in doses varying from 15 to 50 cc. per cub. metre. Afterwards the seeds were removed and put to germinate under filter paper, in the open air without artificial heat, and compared with untreated controls The following tables give the results obtained: —

TABLE I. — *Germination power after treatment with* 15 *cc. of chloropicrin per cubic metre.*

Duration of treatment	Wheat	Rice	Hemp	Flax	Lentils	Fenugreek	Bersim
Control	100	80	69	100	100	100	100
6 hours	93	84	50	100	100	100	100
12 »	82	79	61	100	100	100	100
24 »	70	79	58	100	100	100	100
	66	60	54	100	100	100	100
72	69	39	65	100	100	100	100
96	71	38	64	100	100	100	100

TABLE II. — *Germination power after treatment with* 50 *cc. of chloropicrin per cub. metre.*

Duration of treatement	Wheat	Beet	Flax	Lentils	Fenugreek	Bersim
Control	100	72	100	100	100	100
6 hours.	34	61	95	99	100	100
12 »	36	65	96	100	100	100
24 »	32	58	91	100	100	100

The results show that the destruction of insects parasitic on seeds (wheat and bean weevils, alucides, etc.) is assured by the use of chloropicrin, acting for 24 hours in doses of 15 to 20 cc. per cubic metre. Longer periods of contact and larger doses do not appear to be any more effective.

TABLE III. — *Germination power of wheat treated with 20 cc. of chloropicin per cubic metre.*

Appearance of first sprout		Reference	6 hrs.	12 hrs.	24 hrs.	48 hrs.	72 hrs.	96 hrs.
		3rd day	2nd day	3rd day	3rd day	3rd day	4th day	5th day
Number of germinations after	4 days	54	65	40	53	25	7	0
	6 »	73	77	69	58	49	40	24
	8 »	85	84	76	65	58	54	50
	10 »	94	88	80	71	62	57	62

The action of the chloropicrin on the seeds varies with their nature, the dose given, and the duration of treatment. Certain seeds of legumes, flax, etc. are not affected by it, but on others, such as hemp, beets, etc. and, in particular, cereals it affects the germination energy and power. This unfavourable influence usually increases, with the quantity used and the time of contact.

Under the conditions required for disinfection the germination power of wheat is decreased by 30 %, a percentage which increases with stronger doses. On the other hand leguminous seeds are absolutely immune.

266 - **The Assimilation of Carbon Dioxide by Green Plants.** — MAZÉ, P., in I. *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 26, pp 1391-1393. Paris, Dec. 27, 1920. — II. *Ibid.*, Vol. CLXXII, No. 3, pp. 173-175. Jan. 17, 1921.

I. — Green leaves gathered under sunshine yield substances with an aldehyde action when distilled. The formation of these substances has been attributed to the chlorophyll and some authors, thinking that they had succeeded in identifying the formaldehyde among them, have seen in their results a confirmation of the hypothesis of BAYER and BERTHELOT concerning the synthesis of sugars by green leaves.

The author has tried to give an experimental basis to this hypothesis by making maize plants cultivated in an aseptic medium, absorb solutions of mineral nutrients containing 1-2 gm. of methyl alcohol per litre. But this method has not yielded conclusions favourable to this hypothesis.

He has extended his investigations moreover to the chemical action that takes place in green leaves. Gathered under various atmospheric conditions, the green leaves were at once distilled, without the addition of water, under a reduced pressure at 60° C. The analysis were made on oak, horse-chestnut, sycamore, lime, poplar, clove, elder, spindle, privet, lilac, rose, vine, white clover, lucerne, pea, bean, maize, ray-grass, beet, Jerusalem artichoke, dahlia, dandelion, chrysanthemum, lettuce, carrot, celery, cabbage, potato and night-shade. They did not indicate the least trace of formaldehyde, but nearly all gave ethyl alcohol, acetic aldehyde and nitrous acid. Bean and maize leaves gave acetylmethylcarbinol when the weather was very fine, the elder leaves gave free hydrocyanic acid and glycolic aldehyde, and the poplar gave lactic aldehyde. These three last bodies are formed by the assimilation of carbon dioxide; they vary with the species like all fermentation compounds produced by bacteria and like them they evolve simultaneously towards the synthesis of sugars, fats or nitrogenous matters and aromatic nuclei.

II. — In order to explain the formation of immediate products resulting from assimilation of carbon dioxide by green plants, it becomes necessary to attribute a fundamental part to hydroxylamine. The existence of this base in leaves is made certain:— (1) By the transformation of ammonia into oxygenated nitrogen compounds and *vice-versa*, which takes place normally; (2) by the constant presence of free nitrous acid and, very frequently, of hydrocyanic acid, two derivatives of the oximes. Hydroxylamine, acting first as a base, fixes the Co^2 and forms a compound which decomposes into nitrous acid and glycolic aldehyde:—

$$2\ CO_2\ NH_2\ OH = CH_2\ OH - CHO + NO_2\ H$$

These two compounds were found in elder leaves by the author. The acetic aldehyde, very abundant in green leaves can arise either from glycolic aldehyde by reduction from the glycotic aldehyde, or by the direct oxidation of the alcohol. It can serve as a base for the formation of another series of bodies by combining with the hydroxylamine, passing through the oximes

The glycolic and lactic aldehydes may give rise to other combinations either, by hydration or condensation, by oxidation or by new combinations with hydroxylamine.

As for hydrocyanic acid and acetylmethylcarbinol, they can be considered as already being elaborated products.

All the transformations considered so far can only be made with the help of the energy furnished by the combustion of respiration. They are therefore widely distributed among the living cells, but they are hidden by the inverse phenomenon of respiratory combustion, which liberates a volume of CO_2 which is much greater than that which is assimilated by way of reduction.

267 - **The Secretion of Invertase by Plant Roots. — Experiments with *Pisum arvense* L. and *Zea Mays.* L.** — KNUDSON, L., in *American Journal of Botany*, Vol. VII, No. 9, pp. 371-379, Tables 4, figs. 1, bibliogr. of 9 works. Brooklyn, N. Y., Nov. 1920.

The plants under investigation were grown in water cultures under sterile conditions, that is, with the root system in a nutrient medium free of micro-organisms, and the seed removed from contact with the culture solutions. The PFEFFER nutrient solution was used, with the substitutions of dibasic for monobasic potassium phosphate. The following formula was employed:— calcium nitrate, 4 gm.; potassium phosphate, 1 gm.; potassium nitrate, 1 gm.; magnesium sulphate 1 gm.; potassium chloride

0.5 gm.; ferrous chloride, 50 gm. and distilled water 6 litres. To this sucrose was added, when required.

With the Canadian field pea (*Pisum arvense* L.) the culture vessels were pyrex flasks of 1 litre capacity and the quantity of nutrient solution was 1050 cc. Sterilisation was effected by autoclaving at 15 lb. pressure for 30 minutes and seeds were sterilised by the use of calcium hypochlorite for 1 hour. The plants were grown in a greenhouse at an average temperature of 70° C. Only those cultures that proved to be sterile were analysed. The results indicated that in each of the culture solutions containing sucrose there was an appreciable gain in reducing sugars, but the gain is relatively slight as compared with the total amount of sucrose present, the maximum gain being only $^{1}/_{15}$ of the sucrose present. Experiments with both *Pisum arvense* and *Zea Mays* in slightly modified nutrient solutions with ferric chloride in the place of ferrous chloride, showed relatively the same results.

In order to determine whether or not the enzyme invertase was present in the culture solution, 500 cc. of the solution was incubated for 14 days, at 32° C., with toluene used as an antiseptic agent. No increase in reducing sugar was found at the end of that period, except in one single case with *Zea Mays*, due undoubtedly to the enzyme invertase derived from *Penicillium* contamination.

Further experiments confirmed these results, and the author concludes therefore that the reaction of the culture solution is such as to be without influence on the sucrose. All incubation experiments also yielded negative results with respect to the presence of invertase. The author considers that there is only one explanation to account for the accumulation of reducing sugars, namely, the excretion of reducing sugars by the roots. In support of this idea, the following experiment is described. Three maize plants which had grown for 30 days in PFEFFER'S solution (each weighing approximately 18 gm), were removed, and after washing the roots, were transferred to culture vessels so that roots alone were bathed in a 4 % solution of sucrose. After 16 hours, the plants were again transferred after rinsing, to another culture vessel containing distilled water, and allowed to remain there 7 hours. The total volume of distilled water was then reduced by evaporation to 100 cc and this was analysed for reducing sugar, and the determinations gave 14.5 mgm. of the said sugar.

268 – **Effect of Premature Freezing on Composition of Wheat.** — BLISH, M. J. (Montana Agricultural Experiment Station) in the *Journal of Agricultural Research*, Vol. XIX, No. 4, pp. 181-188. Tables 4, bibliogr. of 7 works. Washington, D. C, May 15, 1920.

A report of an investigation concerning the effect of premature freezing on the more important chemical constituents of the wheat kernel, particularly the nitrogen compounds from which the gluten is formed.

In order to obtain samples of sound and frozen wheat of the same varieties, and grown as nearly as possible under the same conditions, plots were seeded at intervals of a week, for about 2 months, the wheat in all plots being cut either shortly after maturity, or immediately after the first killing frost. A series of plots was seeded in 1917, and 1918. All plots were irrigated in mid July and at obviously different stages of development. The wheat from the 1917 series was brought to the granary shortly after cutting and thrashed when dry enough to permit. The grain from the 1918 series, however, was allowed to remain in the field, after it was cut and shocked, and it was therefore subjected to several months of severe weathering in the field. A chemical analysis of the grain from the two series indicated the appreciable effect on the biological properties apart from the effects of freezing. It was noted that the nitrogen in the α-amino and amide forms as well as the total non-protein nitrogen ran higher in the mature samples of the 1918 than in the corresponding samples of the 1917 series. In a previous paper the author has shown that while the proteins themselves are completely removed in the method of determining non-protein nitrogen, there still remain some peptids in the solutions (1) Therefore the figures for α-amino nitrogen reported include the " exposed " α-amino nitrogen of these peptids as well as that of the amino-acids.

A brief study of the effects of premature freezing on the carbohydrates of the wheat kernel showed that the percentage of reducing sugars, non-protein nitrogen and acid-reacting constituents evidently increased with the severity of freezing. The α-amino fraction of the non-protein nitrogen was also considerably higher in the frozen than in the sound wheat.

269 - **The Influence of Light Rays on *Azotobacter*.** — KAYSER E., in *The Comptes rendus de l'Académie des Sciences*, vol. CLXXI, No. 20, pp. 969-971. Paris, Nov. 15, 1920; vol. CLXXII, No. 3, pp. 183-185. Jan. 17, 1921.

I. — The influence of different light rays on bacteria has already been the object of many investigations. The complete destruction of the micro-organisms, the loss of chromogenic power, and the attenuation of virulence, sometimes the intensification of certain properties as found in the experiments of ENGELMANN with *Bact. photometricum*, have all been observed.

The author has studied this action with *Azotobacter agile*, which is characterised by great motility, the formation of pigment and fluorescence. He again found that the maximum of nitrogen is assimilated with yellow and green and corresponds to the maximum of sugar that disappears, and at the same time to the maximum mass of bacteria collected on the filter. With regard to this, one cannot speak of mathematical proportion (the amount on the filter weighed 71 mgm. for green, 69 mgm. for yellow, 51 mgm. for violet, and only 42 mgm. for red) for in a biological phenomenon, many factors intervene in a more or less tangible way. It is in the blue that the maximum quantity of nitrogen per gramme of sugar decomposed is assimilated. The experiments show, then, besides the influence of radiation, that of the food hydrocarbon, and of the microbial mass. On the other hand it is known that the age, and concentration of the microbes and the temperature also come into play.

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(1) See *R.* June 1918, No. 688.

Tests now in progress will show if luminous induction could confer permanent properties on the nitrogen fixer and give rise to new types. With regard to this the researches of MM. RICHET and CARDOT have shown the remarkable adaptability of micro-organisms to antiseptics. The action of light often gives rise to the production of antiseptics in the environment and when the microbes become accustomed to these modifications they may acquire characters very favourable to the assimilation of nitrogen under agricultural conditions.

II. — In the preceding note the author has shown that *Azotobacter* is sensitive to various light rays and that yellow rays above all others favour the nitrogen fixation.

The author has tried to solve the problem as to whether this property remains constant during a series of generations and what is the action of light on generations of different ages always cultivated under similar conditions of lighting and of the same origin.

The experiments have shown that the total quantity of nitrogen assimilated was always greater with the 3rd generation. The rate varied with the coloration to which the culture was submitted, and the difference between the two generations, very marked with white light, was relatively small for yellow and blue. It is know, however, that with the number of generations the cultures in white light become coloured less and less and more and more slowly; coloration persists with all other colours with varying shades. The nitrogen fixed per unit of carbohydrate decomposed is least with the yellow where the microbe works least economically; the power of assimilation is specially diminished in the 6th generation, with green, white and black. The proportion of glucose consumed is always greater in the 3rd generation, except with blue, for with this colour the 6th generation destroys more mannite than the 3rd generation.

The proportion of carbo-hydrates consumed is highest for cultures exposed to white and yellow light, and is smallest with green; in the presence of glucose, mannite is only slightly attacked. It is due to this colour that the difference between the total of nitrogen fixed by the 2 generations is much greater than for blue and yellow.

Experiments in progress are intended to show whether, under the influence of light, bacteria can be made to acquire their old properties, or even to strengthen them, and also to ascertain to what extent the assimilating power of these bacteria can be diminished.

270 - **Studies on the Root Nodule Organisms of the Leguminous Plants, at the Agricultural Research Institute, Pusa.** — IOSHI, N. V. (First Assistant to the Imperial Agricultural Bacteriologist, in *Memoirs of the Department of Agriculture in India, Bacteriological Series*, Vol. I, No. 9, Pl. 9, tables 12. Calcutta and London, July, 1920.

A report of some interesting work carried on in the laboratory at Pusa to investigate the question of species by cross-inoculation of the organism from root nodules of one plant on another, and the nitrogen fixing power of the organism independent of the plant.

The culture medium employed had the following composition:— soil extract 1000.0 cc; mannite 20 gm.; potassium phosphate 0.5 gm.; agar

20.0 gm. The soil extract was prepared by heating 1 kilo of Pusa soil with 1500 cc. water in the autoclave at 120° C for 20 minutes, allowing it to settle, and filtering off the supernatant liquid.

At first several strains of the nodule organism from cow-pea (*Vigna Catjang*) were isolated, and two were selected for cross-inoculation purposes and to test their nitrogen fixing power. A second experiment was arranged for a greater number of organisms to be cross-inoculated on pea (*Pisum sativum*), math (*Phaseolus aconitifolius*) and gram (*Cicer arietinum*), while a third experiment was arranged to see whether the results could be confirmed by reinoculation of some of the organisms on pea.

The results of the latter 2 experiments show that substantial increase in growth of roots and of the whole plant results from inoculation of root nodule organisms although not always accompanied by nodule formation. The absence of these nodules was thought perhaps to be due to the possibility that nitrogen might be fixed by the organisms in the sand independent of the plant or that the organisms might be present in the roots, but in less virulent form. No organisms were however discovered in the sections of roots examined.

Further experiments were made with *Pisum sativum, Phaseolus aconitifolius, Cicer arietinum, Zea Mays, Avena sativa* and *Triticum vulgare.* It was at once evident that the plants which received nitrates were the best. The leguminous plants inoculated with their own organisms come very near these in quality, and next in order come the cross-inoculated, the *Azotobacter* inoculated, and those grown in porous pots. The effect of nodule organisms on the graminaceous plants is also marked ; of course no nodules were found on their roots.

The results of cross-inoculation showed the following positive results :— *Vigna Catjang* × *Phaseolus ; Pisum sativum* × *Phaseolus ; V. Catjang* × *P. sativum ;* and *Phaseolus* × *P. sativum.* The organism from *Cicer arietinum* has not been found to cross-inoculate *Phaseolus* and *P. sativum* and *vice versa.*

In order to detect the presence of ammonifying and nitrifying organisms, a portion of the sand from the inoculated and uninoculated pots was separately inoculated in each of the following culture solutions : 1) peptone water ; 2) OMELIANSKI solution. After 4 weeks inoculation, nitrites or nitrates could not be found in No. 2 solution showing the absence of nitrifying organisms ; and only after 72 hours was about 4 mg. of ammonia found in No. I solution.

The author desires to point out that the chief reason why the legume nodule organism is not recognised to have been isolated from the soil is that statements have been accepted as correct without thorough examination ; for example, that a nodule organism does not generally grow in ordinary nutrient media and that the organism fixes considerable quantities of nitrogen in culture flasks. Thus when any organism closely resembles the nodule organism and yet does not fix nitrogen in large quantities in the laboratory, the tendency is to take it as altogether different. To prove the inadequacy of this system of reasoning, the author experimented with one of the said organisms and with the same morphological characters as the nodule organisms, and cultures were then inoculated into sann-hemp (*Crotolaria juncea*), arhar (*Cajanus indicus*), cow-pea (*Vigna catjang*) and math (*Phaseolus aconitifolius*). These plants were grown in pots of sterile sand and all showed nodule formation when uprooted at the end of the experiment.

None of the media tried can be called absolutely specific, but an experiment was devised to test which gives the highest number of nodule organisms out of the total number. Nodules of val (*Dolichos Lablab*), indigo (*Indigofera arrecta*) and *Vigna Catjang*, were inoculated into these media. The highest number of nodule-organism colonies were found in the soil extract + mannite + agar and the lowest in the levulose agar (GREIG-SMITH) but this was particularly free from extraneous organisms.

The chief function, therefore, of the root nodule organism appeare to be nitrogen fixation whether within the nodules or outside. The fact that there is no residual nitrogen in the case of the nodule organism as contrasted with *Azotobacter* suggests that the fixation of the nitrogen by the organism and assimilation of the same by the plant with and without nodule formation go on approximately at the same rate. This implies the necessity of the removal of the products of metabolism by the plant before further nitrogen fixation by the organism can take place. Further experiments are necessary to furnish final evidence on this point.

271 - **The Work of the Central Station of Genetics (Experiment Station for the Improvement of Agricultural Plants) at Gembloux, Belgium.** — JOURNÉE, G. and LATHOUWERS, V, in *Annales de Gembloux*, Year 26, Part. 12, pp. 559-566. Brussels, December 1920.

The Experiment Station for the Improvement of Agricultural Plants, attached to the Gembloux Agricultural Institute, carries out its programme of work on the following main lines:—

I. — Experimental selection, and crossing combined with selection.

II. — Cultural tests of the new types thus obtained in the different agricultural regions of the country, with the object of testing their practical value as regards the local agrogeological and climatic conditions (Regional Research Centres).

III. — Enquires as to the value of the principal varieties now cultivated in Belgium.

SELECTION — *Cereals.* — The work of selection is carried out as follows:— From among the descendants of one parent plant those individuals are chosen that possess to the greatest extent the characters to be preserved. The group of individuals thus isolated forms " first choice ", while the rest are the " second choice ". The following year, the offspring of the "*first choice*" are also divided into *first choice* and "*second choice*", and the seed of the best individuals of the latter serve for the " first multiplication ". The best specimens thus obtained are used in their turn for subsequent " multiplications ', whereas the descendants of the " first choice ' continue to be divided into "*first choice*" and "*second choice*'.

The yields of the selected plants, as well as those of the " multiplications ", are analysed with great care, special attention being paid to characters that affect productivity (number of seeds per plant, weight of 100 or 1000 caryopses, % of seeds yield per *are* etc.). These details, in addition to the continual careful observations made during the growing season with the object of studying the resistance of the plants to cold, disease, and lodging, their early ripening, etc., furnish data for the subsequent discarding of the inferior plants, and the isolation of the best.

The improvement of wheat and oats was begun in 1913-1914, and, in 1919-1920, there were 103 pure lines of wheat and 77 of oats being studied. In 1919, the work of improving spelt and winter barley was commenced: 202 parent spelt plants and 172 of barley were examined comparatively.

The parent plants were chosen from plots sown with the seed of varieties from different districts; the examination of the plots will at once show that these varieties are far from being homogeneous, and should rather be regarded as associations of numerous varied forms, many of which are distinguished from one another by constant and well-defined characters.

The Station proposes to separate these associations by isolating pure lines and propagating the best types. Much has already been done in this direction, especially in the case of wheat. Large and complicated crossing experiments are also being carried out with the latter. Crosses between several varieties of wheat have ben made since 1918, and repeated in the following years, in order to obtain types with a higher yield, but at the same time resistant to cold and maturing early.

In 1919, some pure lines of wheat showed " speltoid " mutations, which were isolated, and have now reached the 3rd generation.

Potatoes. — At present 81 lines are being studied, especially as regards high starch content, resistance to disease, cooking properties, and yield. Some already show a good combination of these characters.

Sugar Beets. — In 1915, a " first choice " was made of 100 plants which were selected for shape, weight, and the high sugar content of the root. Then alternate generations of the seed-beets and the roots of the best lines were kept. Little work has however been done, on account of lack of men.

REGIONAL RESEARCH CENTRES. — In 1919, the advisability was discussed of creating branch Stations, or phytotechnical Stations of secondary importance, for the different agricultural regions of Belgium. Three such Stations have already been established, at Brosbeke. (East Flanders), Clavier (Condroz), and Carlsbourg (Ardennes). The duties of these Stations are: —

(1) To study the behaviour, in different soils and climates, of the varieties obtained at the Central Station;

(2) To compare these varieties with the best local varieties;

(3) To try to introduce and acclimatise foreign varieties, especially those coming from N. Holland, or obtained at Svalöf:

ENQUIRIES. — In 1919-1920, at the request of the Central Station, and under the auspices of the State Agriculturists, a census was taken of the varieties of cereals cultivated in Belgium.

The Station keeps constantly in touch with foreign scientific work connected with the genetics and improvement of agricultural plants. All the principal journals dealing with genetics, and the best works that have hitherto been written on the subject of heredity can be consulted at the Station.

In order to facilitate research, all the data have been entered systematically on a card-index.

272 - **Behaviour of Certain Hybrids of Oats and Spring Wheat at Rampart Station, Alaska.** — GASSER, G. W., in *Report of the Alaska Agricultural Experiment Stations*, 1918, pp. 41-47. Washington, Sept. 1920.

OATS. — Hybrid No. 51a, F_2 (Hull-less No. 304-2 × Norwegian No. 117-3 effected with a view to producing a hull-less oat ripening early. As in the F_1 generation, many of the heads presented the unusual feature of bearing both triflorous and polyflorous spikelets, and both hulled and hull-less kernels. The glume were either white, black or dark grey.

One of the chief aims has been successful, namely, earliness. They ripened in 88 days (3 days less than the Norwegian parent from which earliness was inherited).

SPRING-WHEAT. — No. 30a, F_3 (Chogot × Marquis). A true cross inheriting qualities from both parents:

In the all-important quality of earliness it holds an intermediate position, ripening on August 27 (14 days later than the earliest plant of Chogot); Marquis did not ripen either in 1918 or in 1917.

273 - **Improvement by Selection of Yellow Flint Maize in Mauritius.** — AUCHINLECK, G. G., in *Department of Agriculture, Mauritius, Bulletin* No. 18, pp. 1-19, pl. 5, Port Louis, 1920.

A lowering in the number of rows of grain on the ear of maize has a decided influence on the yield. The author considers that the 16 and more types are the most common, and on the other hand, ears possessing 14 rows or less of grain are less frequent.

Although the character in question may be largely influenced by surrounding conditions and present marked fluctuations, it appears, however to depend on elements both fundamental and hereditary.

Evidence that it will eventually be found possible to obtain each type " row true " by means of more careful isolation in the field is afforded by consideration of the marked increase in the frequency of ears of 16 rows and more, which has followed from sowing seed derived from high-rowed ears, and the large number, on the other hand, of ears possessing 14 rows or less, which resulted from planting ears of a small number of rows.

The results so far obtained indicate that ears possessing 12 rows of grain, give a small yield in general (weight of ears and yield per arpent) (1), whilst the 18-rowed and 16-rowed types are robust and good yielders in the field.

The Yellow Flint Maize may therefore be improved by selection based on the character " number of rows of grain per ear ".

274 - **Inheritance of Characters Resulting from a Natural Cross between Two Varieties of *Dolichos Lablab*.** — HARLAND. S. C, in *Journal of Genetics*, Vol. 10, No. 3, pp 219-226 London, Oct. 1920.

Dolichos Lablab L. is naturally self-fertilising ; dehiscence of the anthers takes place at least one, and sometimes 2 days before the flowers open.

The following characters have been studied in these experiments: 1) habit of growth; 2) anthocyanin colouration of flower, seed, and vegetative parts.

HABIT OF GROWTH. — The various races of *Dolichos* may be divided into two main groups, according to whether the growth habit is indeterminate (climbing) or determinate (dwarf or bush). The latter are so called from the fact that the main axis terminates in an inflorescence after from 4 to 8 nodes have been developed and the secondary branches also terminate in flower clusters. With the cross St. Vincent Bush White (bush) × Vilmorin's Stringless (climbing) the following results were obtained :— F_1 hybrids possessed the indeterminate habit;

F_2 : Out of 389 plants, 298 were indeterminate and 91 determinate; ratio 3 : 1.

F_3 : out of 17 families grown from F_2 indeterminates ; 4 bred true to indeterminate, and 13 families segregated into indeterminate and determinate in the 3 : 1 ratio.

Ten families were grown from F_2 determinates ; all these bred true.

From these results it may be concluded that the determinate and indeterminate habits of growth in *Dolichos Lablab* constitute a simple allelomorphic pair of characters, with complete dominance of indeterminate habit. The factor for indeterminate habit is denoted by the symbol I.

COLOURATION OF FLOWERS. — The following conclusions may be deduced from the hybridisation experiments evolved to this end :—

1) Two factors are concerned in the production of the purple colour of the flower ; these may be denoted by the symbols C and R ;

2) In the absence of either factor, the flower is white ;

3) According to this the cross St. Vincent Bush × Vilmorin's Stringless is of the nature cR × Cr. The genotypes appearing in F_2 will be as follows :—

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(1) Arpent = 1.043 acres (*Ed.*)

Homozygous			Heterozygous			
Genotype	No	Colour	Genotype	No	Colour	Behaviour In F_3
			CR Cr	2	purple	3 *p* : 1 *w*
CR CR	1	purple	CR cR	2	purple	3 *p* : 1 *w*
Cr Cr	1	white	CR cr	4	purple	9 *p* : 1 *w*
cR cR	1	white	Cr cr	2	white	All white
cr cr	1	white	cR cr	2	white	» »

This hypothesis is confirmed by the experimental results:

1) The ratio of purple to white in F_2 is 484 : 342 (9·7),

(2) The 25 F_2 whites gave in F_3 only whites;

3) Of 65 families from F_2 purples, 35 exhibited the 9 : 7 ratio, 25 the 3 : 1 ration, while 5 bred true (all purple);

4) White flowered plants, from F_2 or F_3 families, invariably bred true.

CORRELATION OF FLOWER COLOUR WITH ANTHOCYANIN COLOURATION OF SEED AND VEGETATIVE PARTS — The purple flowered cross between the 2 white flowered forms St.. Vincent Bush and Vilmorin's Stringless exhibited:

(*a*) purple colouration of the nodes of the main axis, and to a slight extent, of the veins of the leaf.

(*b*) black seeds. In subsequent generations, all plants with purple flowers possessed purple nodes and *vice-versa*

One of the parents, St Vincent Bush, is entirely devoid of anthocyanin colouration, including the seeds which are cream. The other parent, possesses an extremely minute degree of pigmentation of the stipular hairs, which can only be detected microscopically, the seeds are, however, of a purplish brown colour.

On flower colour alone, it is not possible to distinguish between the phenotypes, Cr cR and cr, for they are all white flowered. The factor C, however, produces visible effects in other parts of the plant body and the combination Cr may thus be easily distinguished from cR and cr, (these two last are so far as we know, indistinguishable).

The factor C produces a purplish brown anthocyanin colouration of the seed coat and a minute amount of pigmentation of the stipular hairs.

The F_1 of the cross Cr × cR is coloured purple in the region of the nodes along the main axis, while the seeds are black. In subsequent generations, all plants with both C and R, have black seeds and purple nodes. It thus appears that the combination of C and R, determines a particular mode of distribution of anthyocyanin pigmentation in the plant body. The factor C determines the production of anthocyanin in seed and in stipular hairs; the factor R combined with factor C converts the white flower into purple and brown seed into black, at the same time extending the pigmentation to include the nodal regions of the stem.

The cross St. Vincent Bush × Vilmorin's Stringless may be represented thus:

PARENTS	*St Vincent Bush*	×	*Vilmorin's Stringless*
	c R		**C r**
	White seed White flower Green plant body		Brown seed White flower Purple stipular hairs

*F*1	**Cc Rr**
	Black seed Purple flower Purple nodes

*F*2 . . 9 **CR**	3 **Cr**	3 **cR**	1 **cr**
Black seed Purple flower Purple nodes	Brown seed White flower Purple stipular hairs	White seed White flower Green plant body	White seed White flower Green plant body

It is clear, therefore, that the best classification of the plants could be effected by examining the seed colour.

In conclusion, it may be taken that 3 Mendelian factors govern these characters:—

I The factor for indeterminate habit.
C The factor for purplish brown seed coat and purple stipular hairs.
R A factor which has no effect except in the presence of C, when it converts white flower into purple, brown seed into black and causes pigmentation of the nodal regions.

275 – **"Kumpta" Cotton and its Improvement in India by Selection and by Crossing Combined with Selection.** — KOTTUR, G. L., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. X, No. 6, pp 221-272, Pl. I-VII. Calcutta, October 1920.

"Kumpta" cotton (which is also known under the names of "miraj", "bail-hongal", bogalkot, and "westerns"), is a type of *Gossypium herbaceum*. It is grown over a very large area in the southern Maratha Country, in Mysore and the Nizam's Dominions, and especially in the Dharwar District.

This type of cotton is not a pure type, but consists of a large number of distinct strains with different anatomical and physiological characters. In other words, "Kumpta" cotton is what is called in genetics a "mixed population".

Let us take, for instance, the number of monopodia which was determined for 979 plants, and may vary from 1-8. The said plants are divided, as follows, as regards the number of monopodia:

Number of monopodia	Frequency
1	0
2	82
3	**268**
4	199
5	**311**
6	93
7	17
8	9

If on a straight line the abscissae 1-8 are marked at equal intervals, and ordinates drawn, so as to form a vertical rectilinear segment corresponding to each pair of these numbers, and of a length proportionate to the number of plants having this determined number of monopodia, on joining the end of these segments, a curve is obtained with two points corresponding to the numbers 3 and 5, and separated by a depression corresponding to the number 4

This is a biometric system for the analysis of intermixed strains, and is based on the variability of their characters If the strain is pure, there will be but one point, on the other hand, if it is mixed, the number of points may exceed 1

In the present case, which refers to the number of monopodia there are, as has already been said, 2 points.

Similar conditions are observed as regards the length of the central leaf lobe (of 1000 leaves).

Length of central lobe in mm	No of times occuring (frequency)
39–42	22
42–45	21
45–48	77
48–51	**250**
51–54	158
54–57	**222**
57–60	120
60–63	62
63–66	9
>66	39

The curve obtained by joining these data would thus have 3 points

As regards the ginning percentage we find. (See table pag 293)

In this case, the curve would have 4 distinct points: in the tables, the figures corresponding to the latter are in thick type.

The above-mentioned data, as well as other facts stated by the author, show that " Kumpta " cotton consists of a complicated mixture of strains. For this reason it is capable of improvement by selection, and by crossing

Ginning percentage	Frequency
18 %	1
19	2
20	9
21	12
22	19
23	11
24	14
25	9
26	6
27	7
28	1
29	8
30	1

combined with selection. Therefore the article analysed gives the results of a series of experiments carried out for the purpose of obtaining (by individual selection and combining the best characters) a type of cotton possessing the following qualities in the highest degree:

1) Large number of fruiting branches (sympodia). When the number of these is large in comparison with that of the monopodia and of the axillary shoots, the number of the bolls, and hence the yield, is increased.

2) Rapid growth, early flowering and ripening, so that the cotton can be collected in two pickings, thus avoiding the ante-monsoon showers of April and May, which often spoil the latter varieties and make the picking difficult.

3) High yield, long staple, high-ginning percentage.

SELECTION BY PURE LINES. — By this means, the following strains were obtained some of which were clearly superior, others inferior to the ordinary mixed type: " Dharwar No. 1 ", " Dharwar N. 2 ", and " Dharwar No. 3 ".

Dharwar No. 1. — Erect habit, with very few monopodia and axillary branches. The frequency curve for the number of monopodia, instead of having two points, has only one, which is a biometric proof of the homogeneous character of the selected plants.

As regards yield, " Dharwar No. 1 " is superior to ordinary " Kumpta " by 20 %. Another characteristic of " Dharwar No. 1 " is its earliness, for while " Kumpta " produces most of its flowers from the 11th to the 16th week, " Dharwar " flowers from the 10th to the 15th week, being thus a week earlier. The later the flowers are produced, the greater is the percentage of those that are shed and never develop into bolls as is shown by the first Table on page 294.

This clearly shows the advantage of early flowering.

Dharwar No. 2. — In " Kumpta " cotton there are both erect and bushy strains. The latter bear a large number of monopodia and axillary branches, which are more or less crowded about the central axis. The yield of these forms is naturally low. " Dharwar No. 2 " is a pure bred line of the

Month	« Dharwar no. 1 »		« Kumpta »	
	Number of flowers marked	Percentage of flowers shed	Number of flowers marked	Percentage of flowers shed
December	120	16.7 %	190	52.7
January	2370	14.8	2 500	36.0
February.	2480	69.0	5 210	79.9
March	50	100.0	20	100.0

bushy type. It cannot compare with ordinary " Kumpta ", and even less with " Dharwar No. 1 " in point of yield, but its ginning percentage is high, equal in fact to that of " Dharwar No. 1 ".

" Dharwar No. 2 " is of no commercial value, but is a proof of the heterogeneous composition of " Kumpta ". It may however possibly form the basis of future crossing.

" *Dharwar No.* 3 ". — This selection from " Kumpta cotton " has a long history dating back to 1901. In that year, a cross was made at Kirkee, by GAMMIE, between two strains of " Kumpta " (neither of them in pure line cultivation). In 1904, some of the most prolific of the plants thus obtained were again crossed, and the progeny were grown at Surat until 1908. The produce was only further selected by mass selection on the basis of ginning percentage and better staple. In 1908, all the plants, which were known under the name of " Kumpta Cross " were transferred to Dharwar, where they were studied and tested. It was found, that the type was not pure, and that it was every year losing its best characters, as the following Table clearly demonstrates.

Year	« Kumpta cross »			« Kumpta »		
	Yield of « kapas » (raw cotton) per acre in lbs	Ginning per cent	Value per *candy*	Yield of « kapas » per acre in lbs	Ginning per cent.	Value per *candy*
			Rs. (1)			Rs.
1908	624	27.1	275	—	—	—
1909	431	25.4	300	—	—	—
1910	516	30.3	300	546	25.5	805
1911	435	26.1	315	360	23.8	290
1912	586	28.0	305	759	24.8	290
1913	456	24.6	235	503	23.3	235
Average	508	26.9	288	549	24.3	280

Rupee = 1s. 4d. at par.

In the short period between 1908 and 1913, " Kumpta Cross " had deteriorated to such an extent, as to be inferior to ordinary " Kumpta ".

Therefore individual selection of " Kumpta Cross " was begun in 1913, and the seed has been maintained in this manner ever since. One of the products of this selection, " Dharwar No 3 " has a higher ginning percentage than " Dharwar No. 1 ", but it flowers a little later. It is, however, superior to ordinary " Kumpta ".

CROSSING AND SELECTION. — " Ghogari " cotton is a variety of *Gossypium herbaceum* which originated in the north of Gujarat. Its sole advantage is its high ginning-percentage (40 % and over). In length and quality of staple, vigour, productivity, etc , it leaves much to be desired.

Crosses were made between " Ghogari " and " Kumpta " with a view to endowing the latter with the character of high ginning percentage.

For a long time, these selections were unsatisfactory, as they continued to split, but finally 2 strains with fixed characters were obtained, " Dharwar No. 4 " and " Dharwar No. 5 ". These strains have the following characters :

Dharwar No. 4. — An intermediate type between an erect and a bushy plant. It however produces no axillary vegetative branches. It flowers early, like " Kumpta ", but is superior to the latter as regards yield and ginning %, but the staple is short.

Dharwar No. 5. — Is bushy in habit of growth, and late in flowering, therefore its yield is small. Its ginning percentage is high, and its staple good. It might also be useful for future crossing.

CONCLUSIONS. — Thus, 5 strains of cotton have been produced, 3 by pure-line selection, and 2 by selection out of a cross.

Dharwar No. 1. — An erect type, staple better than ordinary " Kumpta ", suited for the whole " Kumpta " tract.

Dharwar No. 2. — A bushy type. Staple better than that of common " Kumpta ". Does well in the south of the Belgaum district, and in centre of the Dharwar district (rainfall 750-875 mm.)

Dharwar No. 3' — Similar to No. 2.

Dharwar No. 4. — Semi-erect, an early type... Staple short.

Dharwar No. 5. - A bushy and late type, but with very high ginning percentage and good staple.

" Dharwar No. 1 " and " Dharwar No. 2 " were the two best types. The following Table gives the chief economic values of all 5 types.

Name of Cotton	Yield of « kapas » per acre	Ginning percentage	Yield of lint per acre	Value per *candy*	Value of lint per acre
	lbs	%	lbs	Rs	Rs
Ordinary « kumpta » .	467	25.5	119	500	75
« Dharwar no. 1 » . .	563	28.5	160	526	107
« Dharwar no. 2 » . . .	476	28.5	135	349	60
« Dharwar no. 3 » . . .	450	32.1	157	511	102
« Dharwar no. 4 » . . .	535	32.8	175	470	105
« Dharwar no. 5 » . . .	425	36.4	153	520	101

It is obvious from all these results, and from the descriptions of the types, that have been isolated by individual selection from " Kumpta " cotton, that we have in this cotton as it is usually grown, a mixture of a considerable number of strains differing in character of plant, in yield, in ginning percentage and in the quality of the lint. Some of these strains breed true, hence it is possible by the simple isolation of existing strains to get better types than those furnishd by the original variety. The qualities of earliness, yield, ginning percentage, and staple are in no way opposed to one another, and there is no reason why an early cotton should not also possess the other qualities. The latter are most nearly combined in " Dharwar No. 1 ". But some pure line strains with all the positive characters of " Kumpta ", and with a ginning percentage of over 36, have been obtained by the cross " Kumpta × Ghogari " This would lead to the belief, that it will be possible to go much further and combine in one strain this ginning percentage with the other desirable qualities occurring in " Dharwar No. 1 ". This will be the object of the author's further work on " kumpta " cotton.

276 - **Contribution to the Knowledge of the Phenomena of Self-fertilisation and Cross-Fertilisation in *Brassica Napus* L. var. *oleifera* Moenck.** — NILS SYLVEN, in *Sveri es Utsädesforenings Tidskift*, Year XXX, Part 6, pp 225-244, 9 figs. Malmo, 1920.

In 1918, the author began, at Svalöf a series of pure line selection experiments with colza (*Brassica Napus* L. var *oleifera* Moenck), taking as his starting point, 32 carefully chosen parent plants from a kitchen-garden near Petersborg, in the Province of Kulladal.

The parent plants had grown in the open country, and in contact with others differing from them botanically; they were thus exposed to cross-fertilisation, and as *Brassica Napus* according to the generally-received opinion is highly staurogamous, the descendants of the above-mentioned lines should have possessed the most varied and complicated forms.

Quite the contrary occurred however, the progeny were unaffected, being perfectly uniform and practically similar to their parents; this resemblance extending to all the most important characters: colour of leaves and stem; early ripening; length of petioles; tendency to flower twice; vigour of plant (resistance to lodging); type of inflorescence; colour of flowers; shape of fruit; formation of axillary buds.

The colour of the siliqua can serve as an instance.

In 1918, the 33 parent plants could be divided into 3 groups:

1) yellowish-green; Nos. 16, 20, 27.

2) dark-purple on part exposed to the sun; Nos. 17, 18, 19, 21, 23, 24, 25, 26.

3) pale purple on part exposed to the sun, Nos. 13, 14, 22, 25, 29 and 30.

The descendants of the 3 groups showed the characters of their group, to a large extent, in 1919. Thus, in the case of line 16 (of the 1st group), in only 25 plants out of 425, that is to say, in 5.9 % was the part of the siliqua exposed to the sun of a pale purple colour (character of group 3).

What occurred in the case of one line also took place to a greater, or less, extent in all the other lines, and as regards all the above-mentioned characters.

These phenomena are due to the fact, that colza, instead of being staurogamous, is on the contrary autogamous, as is shown by the anatomical and physiological examination of the flower. At the time when the flower unfolds, the four longest stamens cover, and entirely conceal the style, which at that moment, is of the same length as the two shortest stamens, these latter being bent slightly outwards. Then the style begins to grow rapidly, while the anthers of the four longest stamens open, and bend inwards, forming a sort of cap covering the pistil, and hindering the introduction of any pollen from without. Later on, when the stigma which continues to increase in length succeeds in passing out between the stamens, it cannot escape pollinisation. Cross-pollinisation is however only possible when the stigma, after having forced its way through the protecting stamens, remains freely exposed, but as by this time, it has nearly always been fertilised owing to the above-mentioned reasons, contamination action is almost impossible.

No change in this state of affairs can even be effected by honey-seeking insects, for the latter visit the already fully-open flowers which have been self-fertilised.

Colzas thus behave exactly as if they were autogamous plants.

On the other hand, as we have said above, their progeny is not entirely uniform ; among the descendants of line 16, there occur purple-tinted individuals, an almost certain sign that crossing has taken place.

The author's object in undertaking these series of experiments was to determine (taking the colour of the flower as a basis), the percentage of the cross-pollinations. A parent plant. No. 24, had yellow flowers ; 16 plants out of its descendants (100 in all) had yellowish-red flowers.

Some crossing experiments justify us in concluding that line No. 24 must be regarded as the F_2 generation of the natural cross yellow × red, and that yellow is a dominant colour as regards red. This being conceded, the number of yellow individuals met with in the offspring of the unisolated red parent may be regarded as the percentage of the crossing that took place.

The author has also been able to take the following characters as a means of determining the % of crosses.

1) yellowish-white colour of flowers (this is a repetition of what took place in the case of red).

2) Pure green colour of leaves (as opposed to green with traces of anthocyanin).

3) Light green colour of leaves (as opposed to normal green).

4) Twisting of axis of inflorescence.

The results of the experiments are summarised in the appended Table (page 298).

The difference observed between the unselected plants growing in the open field, and the selected plants is explained as follows :

1) Plants growing in an open field are exposed to all possible forms of crosses, and even to crosses with very different types ;

	Number of crosses in the open field						Number of crosses among selected plants		
	1915			1919			1919		
	minimum	maximum	average	minimum	maximum	average	minimum	maximum	average
Green colour of leaves.	59 %	16 9 %	10 2 %	—	—	—	0 %	8.4 %	2 0 %
Red colour of flowers	—	—	—	12.8 %	29 7 %	19.8 %	—	—	—
Yellowish-white colour of flowers.	—	—	—	22 6	22.6	22.6	—	—	—
Torsion of floral axis.	—	—	—	—	—	—	0	9.1	3 4
Pale tint of leaves	—	—	—	22.6	22.6	22 6	—	—	—

2) On the other hand, selected plants are already very uniform, and the possibility of the occurrence of new externally visible combinations is much reduced. In fact, it often happens, that the descendants of self-fertilised plants, like those of crossed plants, have the same characters.

It is however, of the greatest importance to know for certain the true % of crosses in the selected plants, in order to be able to form an idea of the possibilities of contamination to which the latter are exposed when it is wished to increase, in the same locality, the numerous types obtained from pure lines.

The experiments carried out in this direction in 1919-1920, would seem to show, that when the different types are sown in separate, but contiguous lines, the average number of crosses is 3 %.

When we consider that the number of crosses occurring in a typical autogamous plant like wheat is 1 %, we may well conclude that self-fertilisation is very common in *Brassica*, and a large percentage of the flowers are self-pollinated.

277 - **Crosses between Cultivated Strawberry varieties and Wild Varieties in Alaska to Obtain Hardy Commercial Berries.** — GEORGESON, C. C, and BENSON, C H, in *Report of the Alaska Agricultural Experiment Stations*, 1918, pp 22-23, Washington, Aug. 1920.

For a number of years much attention has been devoted to breeding hardy strawberry plants, suitable to the unfavourable weather conditions in Alaska.

Cultivated varieties of *Fragaria vesca* were hybridised with the two species of wild strawberry, *F. chiloensis*, a native of the coast region, and *F. platypetala*, a very hardy species of the interior.

About 3000 seedlings of these hybrids fruited for the first time in 1918. When fruit is produced the hybrid is numbered, and detailed records are kept of each plant as to date of blooming, character of flower, date of ripening the fruit, size and quality of the berry, prolificacy and vigour of the plant. All those with fruits that measure up to a certain standard of size, flavour, firmness etc. are retained, propagated and sent to other stations for test, and distributed among the settlers free of charge.

Fragraria vesca ♀ × *F. chiloensis* ♂. — Many of these hybrids were tested at Rampart and Fairbanks Stations. Although the mother parent (the cultivated berry) is not considered hardy, and the male parent *F. chiloensis* of the coast region is relatively tender, many of the hybrids, however, proved hardy to a certain extent in the interior regions.

The majority of hybrids produced large attractive berries, some of them of superior flavour, others insipid; as a rule they lacked colour and were soft, and, as a result, preserved with difficulty. They are suitable, therefore, for local consumption, but may not be used as commercial berries. There are only a very few hybrids with fruit in which large size, good colour, good flavour and firmness are combined.

Fragaria vesca ♀ × *F. platypetala* ♂. — A large percentage of the fruit of these hybrids was of good colour, good flavour and firm texture, but they were unfortunately too small and therefore unsuitable for commercial purposes. These hybrids are considered as distinctly hardy.

Another group of crosses has been made between the well-known Pacific coast variety Magoon ♀ with pollen from the wild plant of the interior (♂). So far as tested, this hybrid appears to possess all the desired qualities: large berries of deep red colour throughout, and firm enough to stand shipment. The flavour is good but not superfine.

This work will be continued with the hope of fixing on a single variety combining the qualities of size and colour of the berry with hardiness.

278 - **Results of Crossing the Raspberry Cuthbert with Salmonberry *Rubus spectabilis* in Alaska.** — GEORGESON, C C., and BENSON, C H, in *Report of the Alaska Experiment Station*, 1918, pp. 23-24. Washington, Sept. 1920.

In 1909, crosses were made at the Sitka Experiment Station between the salmonberry (*Rubus spectabilis*) and raspberry var. Cuthbert; the results were, however, unsatisfactory. On many plants blossoms were sterile and failed to set fruit; others were indifferent bearers, and none of them had any qualities that made them superior to good raspberries.

In 1918, however, one hybrid from a cross made in 1916 promised to be of value; the berries were salmon coloured, and of good size and pleasant flavour. This plant was a strong grower and showed some of the characteristics of both parents.

279 - **Red Clover Seed Situation in the United States.** — *The Market Reporter*, Vol. 1, No. 7, pp 97, 102-104, 107, 1 fig Washington, D C, Feb. 14, 1920.

No kind of seed probably has ever attracted the attention of two continents as much as the red clover seed in the years 1918-19. During these two years, the available supply has been lower than at any time since red clover has been extensively used in America. A shortage of some kinds of seeds would hardly cause any disturbance, but when it applied to red clover seed a general commotion was raised because of the great agricultural and economic importance of this crop. Recognising this fact, the United States Bureau of Markets assembled some of the data relative to red clover seed production, sowing requirements, imports etc., obtained from the Bureaux of Crop Estimates and Plant Industry and combined them with some of its own data.

The quantity of seed available in the United States in the beginning of 1920 appeared to be slightly larger than that available at a corresponding time in 1919, but considerably less than that of 1918, undoubtedly much less than normal, as indicated by the following figures showing production, seedsman's carry-over, and imports.

TABLE I. — *Production, carry-over and imports.*

	1917	1918	1919
	lb	lb	lb
Production, including all kinds of clover, chiefly red clover	89 280 000	71 820 000	65 940 000
Carry over July 1	15 533 691	4 177 647	1 858 560
Imports July 1, 1919, 1918 and 1917, to Jan. 31, 1920, 1919 and 1918, respectively	126 900	127 800	9 259 900
Total available supply (less exports) on Feb. 1, 1920, 1919 and 1918 respectively	**104 940 591**	**76 125 447**	**77 038 460**

Although exports of red clover seed are not taken into consideration in the foregoing Table, they probably would not affect the relation between the total supplies of each of the years, because the exports of all kinds of clovers (mostly alsike, but also including white and red clover) between July 1, 1919 and December 31, 1919, were only 13 000 lb. larger than between July 1, 1918 and December 31, 1918. This difference probably was more than offset by the estimated larger exports of red clover during January 1919, than during January, 1920.

On January 1, 1919 and February 1, 1918, the stocks in the dealers' hands, less the carry over from the preceding July 1, and imports between that date and January 1, 1919 and February 1, 1918, respectively, were approximately 25 % of the total production of clover seed for 1918 and 1917. If this same percentage held true on February 1, 1920, it is estimated that the stocks in dealers' hands were about 27 500 000 lb. compared with 23 330 920 lb. on January 1, 1919, and 32 532 410 lb. on February 1, 1918; which figures for the latter dates were obtained from seed surveys.

The larger stocks on February 1, 1920 compared with the preceding year are considered due to the much larger imports since July 1, 1919 than for the same period during the previous year. The imports for the fiscal year ending June 30, 1920 are larger than those for any complete fiscal year since 1911, with 2 exceptions, as may be seen from the following figures:—

TABLE II. — *Imports for fiscal years ending June 30.*

	lbs.
1911	6 142 981
1912	19 674 155
1913	5 332 947
1914	5 920 934
1915	8 932 293
1916	32 508 537
1917	5 343 600
1918	768 300
1919	1 050 900
1920 (July 1919 to Jan. 1920 incl.)	1 259 900

It is interesting to note that approximately $^{7}/_{8}$ of the red clover that was permitted entry between July 1, 1919 and November 30, 1919, originated in Italy, and $^{1}/_{8}$ in France. The recent strike in the shipyards in Italy has delayed the arrival of seed bought by American seedsmen, but it is reported that after these belated shipments are received, there will be much more seed available from Italy and France.

The demand for red clover seed from European countries was not so urgent in the winter 1919-20 as in the previous year; fortunately Italy and France had surpluses of this seed to offer, and while undoubtedly the world stocks of red clover are much below normal at this time, they do not appear to be so short as they were the preceding year.

280 - **A New Process of Seed Preparation in Canada.** — EASTHAM, A. (Chief Seed Analyst), in *The Agricultural Gazette of Canada*, Vol. 7, No. 11, pp. 877-878, Ottawa, Nov. 1920.

A new method of cleaning and grading seeds and grain has been invented and patented by E. E. EDDY, formerly Chief Seed Inspector of the Department of Agriculture. The separation is made entirely on the basis of comparative specific gravity. This is effected by subjecting the stock to centrifugal action in the presence of a liquid which is of the specific gravity required for the separations desired.

A suitable material for making a liquid of the desired density is sodium nitrate, but other substances may be used. With seeds weighing about 60 lb. per measured bushel, such as alfalfa and clovers, a solution of about 1.2 specific gravity is required. By regulating the density of the liquid, the proportion of seeds which pass into the heavy and light separations is under complete control.

Tests of several samples of red clover showed a perfect separation of several kinds of the most common weed seeds, classed as noxious under the Seed Control Act. Almost equally valuable were the results in reducing the less harmful species.

Equally good results were obtained with alsike, alfalfa and timothy seed. Tests so far have been made mostly with small seeds. It is expected, however, that valuable results will be secured also with grains by removing barley and oats from wheat, oats from barley, etc. in addition to the separation of weed seeds.

The process is now being developed with the idea of putting it on a commercial basis, and should this be accomplished, there should be a great improvement in the purity and general quality of the seed available, and the seed growing possibilities both for small seeds and seed grain will be greatly increased.

281 - **Wheat Varieties at Verrière, France, 1919 and 1920.** — DE VILMORIN J., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 36, pp. 868-873. Paris, Dec. 1, 1920.

WEATHER CONDITIONS. — Crop *Season* 1918-1919: heavy rainfall from autumn 1918 to January 1919; fairly severe cold and snow in February; damp retarded spring sowings in March; dry weather up till July. The rains may be taken as too late as a general rule for spring crops

Season 1919-1920: mild winter: spring mild and premature. Somewhat cool at earing time; fertilisation hindered; heavy rains just before ripening; damp and cold retarded growth and favoured the attack of rust.

Result on Experimental Plots (25 *sq. m.*).
Most productive varieties of autumn sown wheats.

Name of variety	1918–1919 Yield		Name of variety	1919-1920 Yield	
	in grain	in straw		in grain	in straw
	kg	kg		kg	kg
Hybrid n° 418/20	17.990	31.780	Blé hybrid n° 419/20 . . .	17.385	30.615
Hybrid n° 419/20	17.625	30.875	Grosse tête	16.505	32.995
Rieti	16.050	29.115	Hybrid n° 418/20	16.435	30.230
Hybrid de la Paix.	15.840	26.160	Massy	16.405	30.095
Hybrid n° 421/20	15.025	23.640	Hybrid de la Paix.	15.515	28.885
Hybrid n° 427/20	14.460	26.040	Hybrid n° 421/20	15.500	28.965
Perle de Nuisement	14.350	28.150	Hybrid n° 427/30.	15.495	28.740
Gros bleu.	14.235	24.415	Teverson	15.485	31.115
Rouge prolifique barbu. . .	13.740	26.925	Trésor	15.360	36 940
Grosse tête	13.350	21.815	Hybrid n° 403/20	14.955	24.945

Spring Wheat (*Experimental Plots* 25 *sq. m*).

Name of variety	1918–1919 Yield		Name of variety	1919–1920 Yield	
	in grain	in straw		in grain	in straw
	kg	kg		kg	kg
Hybrid 561/20	8.600	9.200	Hybrid 561/20.	9.715	17.365
Hybrid 568/20	8.425	10.505	Aurore.	9.[illegible]85	21.045
Aurore	8.325	9.575	Hybrid 568/20	9.508	22.132
Hybrid 275/19	7.500	8.000	Saumur de Mars	9.245	20.925
Mais barbu ordinaire	7.435	11.165	Mars de Suède rouge barbu .	9.165	24.465
Manitoba (Red Fife)	6.715	9.285	Manitoba (Red Fife). . . .	8.980	17.695

Results on Large Scale.
Autumn Wheats.

Name of variety	Yield quintals per hectare	Name of variety	Yield quintals per hectare
418/20	38	Bon Fermier *	28
X	29	Hybride de la Paix	44
Hybride de la Paix	28	Inversable	32
Blé des Alliés	28	Blé des Allies	31.5
Blé de la Paix	31	Grosse tête	31
Blé des Alliés *	31	Inversable *	30
Inversable *	28	Bordeaux *	29

* At Massy-Palaisau.

282 – **The Wheats of Cyrenaica.** — SCAETTA, H., in the *Giornale d'Agricoltura della Domenica*, Year XXXI, p. 35, 3 figs. Piacenza, January 30, 1921.

Libya possesses varieties of wheat, which acclimatised as they are to a hot, arid environment, can do equally well in other countries with similar conditions. For many years, Tripolitan wheats have been tested in Sicily, and some of them, having given excellent results, have been grown there of late fairly extensively.

The author mentions 3 of the best varieties of wheat from Cyrenaica —

" *Mogarbia.* . " — This is the most popular variety of wheat cultivated in the Colony. The grain is hard and the vegetative cycle rather short. The natives sow it in the second fortnight of November, and it ripens during the last 10 days of May or at the beginning of June. This wheat tillers well, especially if the ground is properly worked, and if it is sown in good time. The author has counted as many as 30 culms on one plant, all equally strong. The root system is not much developed, but this may be due to the traditional Arab method of cultivation (the grain is sown on hard soil, which is only ploughed to a depth of 10 cm. with a wooden plough).

" Mogarbia " is resistant to lodging, and seems immune to smut (*Tilletia Tritici*). It has the following characters:—

Ear black, awned, square; average number of fertile spikelets 18 to 20, minimum 16, maximum 24.

Spikelets with 4 or 5 fertile flowers. Average number of caryopses per head 67 to 68, minimum 50, maximum 95.

Glumes ovate-lanceolate, with very prominent keel, ending in a short pointed beak; 2 complete veins; brown border.

Pales oval, inflated, ending in very long awns, brown at the base and in the middle, and dark-red towards the top, section triangular at base; length 120-200 mm.

Caryopses of a fine wheat-yellow; of oval somewhat gibbous shape, ventral surface concave. Average length 8.1 mm.; average breadth

3 2 mm. Fracture glutino-horny, almost regular, edges rounded. Weight of 1000 caryopses 56 gm.

Culms strong from 1 m to 1.20 m. in height; on alluvial soils (such as those of the Bomba region, they are from 1.50 m. to 1.60 m. high.

Yield varies much according to the annual rainfall and the prevalence of the "ghibli" (wind from the desert) in spring. In good seasons, it produces 30 times the amount of the seed-corn, or even more

This variety should not be thickly sown; 35 to 45 kg. is cnough per hectare. All these data refer to the native system of cultivation.

"*Misko*". — This variety in its value and commercial qualities comes immediately after "Mogarbia". It is much grown throughout the Colony, and is particularly liked by the natives for bread-making. Its vegetative cycle is longer than that of "Mogarbia". The natives generally sow it in the second half of November, and it usually ripens early in June, 10 or 15 days later than the "Mogarbia" variety. The desert winds of the spring have a great effect upon the date of its ripening but all cereals mature very rapidly in Cyrenaica.

The characters of "Misko" are as follows:—

Ear red square pointed; average number of fertile spikelets 22; minimum 18, maximum 26

Spikelets with 4-5 fertile flowers; the number of caryopses varies per ear; minimum 35, approximate average 45-50, maximum 65

Glumes oval, keeled, terminated by short pointed beak. Two complete veins, edges light-red.

Pales oval inflated, light-coloured in the lower and middle portions, red in the upper, terminated by a long dark-red awn, triangular in section at the base. The longest awns are found, as in "Mogarbia," in the middle of the ear; they vary from 150 to 200 mm.

Carvopses of pale straw-colour; their dimensions vary according to their position on the ear, less distinctly convex than in the case of "Mogarbia"; ventral surface concave. Average length 1.7 mm. · average breadth 3.6 mm

Fracture. Glutino- starchy, very irregular with marked edges Weight of 1000 caryopses 60 gm.

Tillering remarkable.

Culms strong about 1.20 m. in height; in some parts of the interior, such as Ouadi Mhallag they even grow to 1.60 mm.

Yield. As compared with "Mogarbia", this variety is late, and therefore regarded as less resistant to adverse conditions, especially to the "ghibli". Its yield is very uncertain, varying from 5 or 6 to 1 to a maximum of 30 or 35. It is reckoned that the average crop produced is 15 times as much as the seed-corn. (These data also refer to the Arab methods of cultivation).

"*Screisra*". — This is a mediocre variety. It has, however, the advantage of having a short vegetative cycle, scarcely longer than that of barley The natives sow it during the last days of November and early in December. This wheat ripens in the first half of May. Its culms are from 80 to 90 cm. in height.

"Mogarbia" and "Misko" are very resistant to the "ghibli", whereas the Screisra variety, when scorched by the desert wind, sheds its caryopses.

283 - **The "Cignarellone" Wheat of Molise, Italy.** — Iosa, G., in *L'Italia agricola* Year LVIII, No. 1, pp. 1-7. 4 fig. Piacenza, January 15, 1921.

This variety of wheat, also called "cignarello mashio", or simply "grano maschio", is cultivated in a small, but characteristic, area of Molise, at an altitude of 600-800 m. above sea-level. This zone includes the districts of Barabello, Busso, Campobasso, Campodipietra, Colledanchise and Vinchiaturo.

The conditions favourable to the cultivation of "cignarellone" in the above-mentioned zone are the nature of the soil, which is of a clayey character, the climate (the mean rainfall being 443.6 mm from April to October, while the summer is relatively cool), the presence of artificial meadows planted with sainfoin, and often with lucerne and clover, and finally, the very careful preparation of the ground, which is usually hoed by hand. The fact that this wheat is greatly in demand for the manufacture of short and fine types of Italian macaroni, and for making cakes and biscuits has much contributed to its diffusion, not to speak of its high average yield, and its maximum crops, which are sometimes very heavy.

"Cignarellone" is a turgid wheat with the following principal characters:—

Roots.— Numerous, branched, strong, deep, from 25-30 cm. in length, if carefully extracted from the ground their diameter, at the point of insertion is from 2 to 3 mm.

Culms. — Well developed, very strong, empty near the ear, from 0.85 m. to 1.75 m. in height, with an average of 1.32 m. as determined by examining 97 plants Nodes 4 to 6 in number, large, prominent, internodes slight grooved. Diameter 5 to 7 mm. at 3rd internode.

Leaves. — Broad, fine, with long sheath, of a beautiful glaucous green colour, with waxy cuticle and conspicuous veins. The last leaf, together with the sheath embraces a large part of the upper internode.

Ears. — Large, of square pyramidal shape, compact, awned; colour pale yellow, deeply shaded with dark violet; 5 to 8 cm. in length (average of 95 ears, 6.51 cm.), bent over when ripe. There are, however, some ears that are completely yellow, and others with distinct black spots only on the two surfaces.

Axis of inflorescence and rachis, strong, very resistant.

Spikelets. — 23 to 27 in number, arranged in 2 rows with 3-5 fertile flowers.

Glumes. — Somewhat small, oval, inflated, keeled, with beak.

Pales. — Well developed, oval, the inner one with distinct long awn, the outer inflated, deep, sharp, awned.

The awns are 9 to 12 cm. in length, they are more or less separate, forming an angle of 15 to 45°; those at the base and top of the ear are nearly of the same length; they have a groove on the outer side.

Caryopses. — From 65 to 95 per ear on the principal culm; they are yellow, large, round, and have a wide distinct embryonic depression, and a deep ventral grove. Longitudinal diameter 6-8 mm.; transverse 4-5 mm. Fracture starchy, or glutino-starchy.

Weight of 1 000 seeds 70-80 gm.; volume 33 cc.; weight of litre 789 gm.

Tillering — Abundant, but the secondary culms frequently bear empty ears.

The examination of 97 plants gave the following results:—

Plants	with	1	complete	ear	78
»	»	2	»	ears	12
«	»	3	»	»	5
»	»	5	»	»	1
»	»	6	»	»	1

Ripening. — Rather late, from July 10-20, in normal years, at altitudes of 600 to 800 m.

Rust-Resistance. — Rather remarkable; resistance to lodging and grain-shedding very considerable. The culms do not lodge easily on very fertile soils rich in nitrogen. They even resist heavy storms. The ears never shed their caryopses, even if shaken.

Like all turgid wheats, "cignarellone" is a very exacting plant requiring the dampest and deepest soils possible; *e g* clays, sandy, or rich loams.

It does well if planted after sainfoin, lucerne or clover, or after a well-manured maize crop, but on sowing again on the same ground less satisfactory results are obtained.

The soil must be well prepared; it should be worked fairly deeply and very thoroughly. In the zones where "cignarellone" is grown hoeing is very advantageous to the crop.

Few varieties of wheat show themselves so susceptible to the direct application of complete fertilisers.

Experiments made in Molise in 1900-1901 by applying to the soil (after harvesting a lightly manured maize crop) 400 kg. of superphosphate per hectare at the time of sowing and 125 kg. of sodium nitrate in the spring gave 2413 kg. of cignarellone grain per hectare, whereas only 1637 kg. were obtained from the unmanured field.

This wheat should be sown early, at the end of October at latest and it should not be planted thickly, on account of its tillering propertities and the need of thorough hoeing.

When grown in a suitable environment, "cignarellone" gives a high and constant yield. In seasons when more delicate varieties succumb to great extremes of temperature, drought, or excessive damp, this wheat is remarkable for its resistance, and its relatively high yield. Farmers who have grown "cignarellone" for several years testify that its minimum yield has never fallen below 12-14 quintals per hectare, and that its maximum yield in good seasons has been as much as 25-30 quintals which is a heavy crop for the Apennine districts. The average yield is from 15 to 18 quintals per hectare, a production which is fairly certain.

The following results were obtained in the course of experiments made at Campobasso in 1920 (a bad year for wheat), both by farmers (1-3 experiments), and also in the field belonging to the Ambulatory Chair of Agriculture, Molise, " Cignarellone " being compared with other well-known varieties :—

No. of Experiment	Varieties of wheat	Production of grain in quintals per hectare
	Carosella " Todaro 91"	18.15
	Carlotta Strampelli	15.40
	Noé	14.70
	Blé de Mars local	6.90
	Cignarellone	18.90
	Carosella " Todaro 91 "	17.00
	Carosella local	12 10
	Cignarellone	16.60
	Carosella " Todaro 91 "	20.50
	Cignarellone	25.30
	Carosellone local	18 10
	Carosella local	18.60
	Cignarellone	19.10

The presence of some glutinous grains, and the fact that the fracture is starchy-glutinous would give cignarellone the character of a semi-hard wheat.

There are, however, different types in which sometimes the starchy grains, at others the glutino-starchy grains are in excess Experts attribute this fact to the soil on which the wheat has been grown, but very probably it is also due to confusion between the races.

The following percentages have been obtained in analyses carried out at the " R. Laboratorio di Chimica Agraria " at Avellino The sample came from the Experiment Field of the Ambulatory Chair of Agriculture of Molise, at Campobasso.

	Per cent.
Starch and sugar	71.02
Fats	1.60
Crude fibre	2.24
Ash	1.80
Nitrogenous substances	10.19
Undetermined substances	1.24
Water	12.82

The percentage of damp gluten in whole flour prepared in the laboratory was 21 %. Bread made with "cignarellone" flour is not of first rate quality, but the flour is greatly in request commercially for making "galettes" and biscuits.

According to the larger or smaller amount of grains with starchy fracture, this wheat is either used for semolina, to improve the colour of macaroni, etc., or is used alone in the manufacture of Italian macaroni of the best quality.

284 - **Field Experiments with Wheat in Western Australia 1912-1919.** — SUTTON, G. L. (Agricultural Commissioner for the Wheat Belt), in the *Department of Agriculture, Bulletin* No 63, pp 3-58 + figs 12. Perth, 1920

Report of experiments carried out at the Chapman and Merredin Experiment Farms dealing with: 1) depths of ploughing; 2) soil mulching; 3) fertilisers; 4) rotation; 5) wheat varieties; 6) rates of seeding.

There is a wide variation in the character of the soils at these two farms. At Merredin the soil is a rich clay loam and at Chapman a light-sandy loam. The 8 years average rainfall (April to November) in the former district was 989 (calculating that 100 points = 1 inch), and 1662 in the latter.

The methods adopted for all operations connected with the preparation of the land; planting and harvesting the crop, were similar to those adopted generally on a large scale.

I. PLOUGHING. — Conclusions drawn from results obtained by ploughing at 4,6 and 8 inches respectively are that on the fertile forest soils shallow ploughing is as effective as deep ploughing, but it is more important to work the land thoroughly than deeply. On lands less fertile, deeper and equally thorough ploughing is advisable.

II. SOIL MULCHING. — The object of this experiment was to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer On the light sandy loam the average results were considerably in favour of the cultivation after fallowing and before seeding, with a further slight advantage in favour of the cultivation after rain during the summer. On the rich clay loam, the average yields were remarkably similar, but somewhat, inconsistent as far as hay yields are concerned, for grain, cultivation was advantageous to a slight extent, at least in the spring.

III RATES OF SEEDING — A comparison between the use of 30 lb., 45 lb and 60 lb. per acre, each plot undergoing the same cultivation, manuring etc From the results obtained, it appears that the amount of good vigorous seed recommended to be sown per acre in the warmer portions of the wheat districts is 45 lb., on clean ground, and in the cooler districts or on weedy ground the amount should be increased 25 to 30 %. It should be noted that the seed used in these experiments was graded.

IV. FERTILISERS. — The prevailing conditions made it impossible to draw any but the most general conclusions from the results obtained on the light soil, but on the clay loam on the forest land in the Eastern Wheat Belt the following conclusions may be drawn: 1) that the application of superphosphate is essential for best and most economical results with wheat; 2) that for grain purposes an amount ranging from 56 lb. to 112 lb is most profitable in this particular climate, 3) that for hay the amount can exceed 112 lb with advantage; 4) that it is not advisable to use bone manure, rock phosphate or "guano" from the point of view of cost; 5) that liming is not profitable.

V. VARIETY TRIALS. — During the trials, a number of varieties were discarded, but of the original varieties retained at Chapman, in 1919, the Comeback var took the leading place for hay, and the Nabawa var. for grain According to the average for 7 years, the following list shows the order according to their percentage yields

Hay		Grain	
Florence	102	Florence	107
Comeback	100	Yandilla	103
Firbank	97	Comeback	100
Yandilla King	85	Firbank	87

At Meredin, a number of varieties have been discarded during the trials, but conclusions drawn from the results generally, point to the fact that "Federation" is to be recommended for early planting, where rust need not be feared; 'Gluyas Early' for mid season or main planting, and "Florence" for later planting. The early districts are those with comparatively light rains and warm weather in October, the mid season, those with heavier rains in October, and the late those with cooler weather and liberal October rains

VI. ROTATION. — On the light lands the following 4-course rotation is recommended as a result of various comparison trials. 1) Fallow; 2) Grain or hay crop, 3) Fallow, 4) Fodder crop (grazed); and until a reliable legume is found which can be used as a fodder crop, oats should be grown.

On the rich clay, the following 3 course rotation is advised namely; 1) Fallow; 2) Crop 3) Stubble. The results justify on economic ground, the practice of continuous wheat in the early years of pioneering.

265 - **Wheat Growing in the State of Parana, Brazil.** — *Lavoura e Criacão*, Vol. V, No 12, pp 284-285 Rio de Janeiro, Dec 1920

A report presented by M. ZDENEK GAYER, agricultural expert, to the "Serviço de Fomento agricolo" of Brazil.

In the State of Parana, wheat is cultivated in the municipalities of Arancario, Campo Largo, Curityba, Lapa, Palmeira, Prudentopolis, Rio Negro, and San José dos Pinhaes, and in the colonial groups of Rio Claro, Vera Guarany, Cruz Machado, Senador Corrêa and Yappo.

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The soils which are preferred are red, compact, sandy clays; more fertile soils can be used if liberal dressings of organic manures are applied. The most popular varieties are "Barletta", "Rio Grande do Sul", "typique de l'Argentine" (of the municipality of Rosario).

The preparation of the soil is very rudimentary, and consists only of a shallow ploughing a little while before sowing, and it is due to this that many weeds come up and greaty decrease the crop.

Manuring is limited to the use of fertilisers, particularly phosphatic ones, amongst which superphosphate has given the best results and experiments on a small scale have shown that green manuring is very successful.

No sorting or disinfection of the seed is carried out. The seed is sown broadcast, very rarely with seed drills, in lines 15-20 cm. apart. About 60-140 kg. of seed is used per hectare. The larger quantities are used in late sowing on poor soils.

The average yield per hectare is 15-17 quintals of grain and 20-40 quintals of straw. The weight of a hectolitre is 80-83.5 kg. The vegetative period is 160-180 days. Reaping is done by hand, with the aid of a sickle. The cost of production of 1 quintal of wheat is 12 *milreis* (1 paper milreis = 6s. 8 ½d. at par).

The chief diseases of wheat in Parana are smut and rust.

286 - **The Green Manuring of Rice Fields** (1). — CHIAPPELLI, R., in the *Giornale di Risicoltura*, Vol X, No. 8, pp. 117-119. Vercelli, Aug. 31 1920

As the price of nitrogenous manures are now so high., the most economical way of applying nitrogen to rice fields is by green manuring with Leguminosae. The most suitable legume for this purpose is crimson clover which, possessing thick and rigid stems, decreases the tenacity of the earth, makes it very porous and, because it decomposes slowly, is effective during the whole period of growth of the rice. But the soil must be well prepared for the rice, must not be too cold, and should contain a little lime

The best time for sowing the crimson clover is a little before the rice is harvested, when the water has already been drained off, so that the seed can be sown on the still muddy soil. After the rice is harvested, an abundant dressing of basic slag or superphosphate is given, plus 5 or 6 quintals of calcium sulphate per hectare.

With old rice fields a light nitrogenous dressing such as 50 kg. of sulphate of ammonia or nitrate of soda per hectare would be useful It is most important to keep the furrows weeded and to deepen them if the rice field is old and "sortumose" (2) so as to prevent stagnation, this being one of the causes of failure with clover. Occasionally rolling may be necessary in spring.

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(1) See *R.* April 1920, No. 417. (*Ed.*)

(2) When the rice is affected by "Sortume" the water rises from the subsoil to the surface soil. See *R* Feb. 1920, No. 173. (*Ed.*)

287 – **Irrigation of Potatoes.** — POWERS, W. L. and JOHNSTON, W. W., in *Station Bulletin No. 173* [*Oregon Agricultural College Experiment Station, Department of Soils*, pp. 5-28, tables XVII. Corvallis, Oregon, Aug. 1920.

Irrigation of potatoes has been carried out for the past 12 years at the Experiment Station, under conditions where rainfall for the growing season, April 30 to October 1, is 5 ½ inches, and the average evaporation about 24 inches for the period. The silt loam on which these experiments were conducted has a maximum capillary water content of about 34 %, an optimum moisture content of about 24 %, and a wilting point of about 14 %. The minimum moisture content under field conditions is 10 or 11 %

The most economical returns were secured with light frequent irrigations, which provide a uniform moisture content, for example, 1 inch every 10 days has given good results and is practicable, and much preferable to one heavy irrigation. The best results were obtained when the depth applied per season was 6 inches in wet seasons and 2 or 3 inches in dry seasons, while the maximum yields were produced with 3 or 4 inches in wet and 6 inches in dry seasons. Application of 9 inches depth decreased the yield.

Applying water in furrows 10 to 18 rods long has proved a suitable length of run for the silt loam. It was found disastrous during the experiments to neglect cultivation after irrigation. Water requirement can be greatly reduced in irrigation farming by keeping up a good rotation, including legume crops; by using good varieties; by maintaining a good fertility and tilth, and by irrigating at the right time in the proper amount.

Proper irrigation does not injure the palatability or marketability of potatoes and after 12 years there was little appreciable effect upon soil acidity or the content of available plant food. From the various determinations made, it appears that the moisture content is not appreciably increased by irrigation, except when applied in excess and then the potatoes had a less firm skin and were less solid. Proper irrigation decreased the percentage of culls

. In Central Oregon experiments, potassium sulphate increased the yield per acre inch from 24 ½ bus. on untreated to 39 bus. on treated land.

In Eastern Oregon irrigation of 5 to 9 inches depth per acre has given the best results in several of the potato producing sections, and frequently best returns have been obtained with 6 to 8 inches total depth, applied in 2 or 3 doses.

288 – **Use of Sour Clover (*Melilotus indica*) as a Rice Rotation Crop.** — MORSE, S. F., in *The Rice Journal*, vol. XXIII, No. 11, p. 46. Beaumont, Texas, November 1920.

This legume has been used successfully following fall-planted sugar cane and makes a winter growth of 18 to 24 inches in 3 to 4 months. The author recommends its use also as good crop between rice crops. *Melilotus indicus* will grow under very adverse soil conditions, and the seed is cheap. By double disking the rice stubble in September or October, and sowing broadcast 25 to 30 lb. of seed per acre, a good stand should be secured.

It is probable that simply scattering the seed over the stubble without harrowing would give good results, but this has not yet been tried. To be sure of a stand on land where this crop has never been grown, it is advised firts to inoculate the seed.

The above mentioned suggestion is made to encourage the use of this sour clover in preference to the white dutch clover (*Trifolium repens*) previously suggested by Hewes, owing to the uncertainty as to whether the latter would make enough winter growth to justify its use, except where the land was to be left lying out in pasture for 2 or 3 years.

289 – Growing of Sunflowers (*Helianthus annuus*) in Montana and Use as Silage (1).

— Atkinson, A., Nelson, T. B., Arnett. C. N., Joseph, W. E. and Tretsyen, O, in *University of Montana Agricultural Experiment Station, Bulletin* No. 131, pp. 3-29, tables 4, figs 4. Bozeman, Montana, April 1919.

A brief survey of the characteristics and history of the cultivated sunflower, followed by the results of tests on yields and methods of growing and feeding, as employed at the Montana Experiment Station.

Preliminary tests were carried out from 1915-18 inclusive, to find the crop yield A comparison of yields shows that while the heaviest yield is from the earliest planting, there are peculiar variations as the date of planting advances. Observations on the growth of the crop led the authors to recommend that planting should be made in the higher altitudes, where the season is short, and as soon as the ground has become warm and is in good condition in the spring. After planting in rows and drills at different distances apart, it was found that the largest returns, 44.1 tons per acre, was obtained from those planted in rows 36 inches apart, and in drills from 30 to 36 inches apart and 4 to 5 inches between seeds. In date-of-seeding tests, the largest yields were produced from the carliest plantings.

Dry land tests were made in 1918 on 13 different farms in 8 counties, and over 30 acres were planted. The average yield was 10.3 tons per acre. As this was a season of unusually low moisture precipitation, the authors consider it reasonable to conclude that sunflowers are a promising dry land forage crop.

Seed matured only one out of 4 years at the Bozeman Station. From observations, however, it appears that seed should mature regularly in the lower vallies where the temperature is higher and when there is a longer period free from frost.

Practical and experimental results up to date, feeding qualities, yields per acre and frost resisting qualities, all considered, were greatly in favour of sunflowers compared with other silage crops. It was successfully used in winter feeding practically with every class of farm stock, but it was found better to make a combination with dry roughage such as clover, alfalfa, or mixed hay.

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(1) See *R.* April 1919, No 493, *R.* October 1920, No. 1008 (*Ed*)

Mammoth Russian sunflowers were successfully used for both soiling and silage purposes during the 4 years trial. Silage made from plants 30 % in bloom, compared favourably in digestible nutrients with maize silage made from immature maize:

Digestible Nutrients	Total dry substance	Crude protein	Crude fibre and nitrogen free extract	Ether extract	Nutritive ratio
In 100 lbs. of sunflower silage	21.4	1.24	10.13	0.37	9.8
In 100 lbs silage from well matured maize	26.3	1.1	15.00	0.70	15.1
In 100 lbs. silage from immature maize	21.0	1.0	11 40	0.40	12.3

No difficulty was experienced in getting cattle, sheep, or pigs to eat this silage. Some animals required a few days to become accustomed to it, while others ate readily the first time it was offered No objectionable flavours or odours could be detected in milk from cows fed thus.

Experiments were conducted from 1916-1918 to determine the relative feeding value of sunflower silage, clover hay and alfalfa hay. Results showed that 3.75 lb. of sunflower silage was equal to 1 lb. of choice aisike clover hay, when fed to cows receiving grain and a limited hay ration, and 2.83 lb. was equal to 1 lb. of alfalfa hay.

Chopped green sunflowers 30 to 40 % in bloom, were equal to chopped green corn in the roasting ear stage as a soiling crop for dairy cows. Experimental work up to the present, indicated that 30 % in bloom has a higher feeding value than silage made from plants less mature. The exact stage of growth that will give the highest quality of silage has not yet been determined; experiments are now in progress.

The silage was found a valuable substitute for part of the hay ration for breeding ewes and brood sows; 2.5 lb. of silage replacing 1 lb. of alfalfa hay in an entirely satisfactory manner.

The most practical method of harvesting sunflowers was found to be with the ordinary corn binder.

290 - **Flax Growing Experiments in Ireland, 1915-1919.** — *Department of Agriculture and Technical Instruction for Ireland, Journal,* vol. XX, No. 3, pp. 351-361, tables IX, Dublin, 1920.

I. — MANURIAL EXPERIMENTS. — A summary of the results obtained from the 4 series of experiments conducted by the Department during the years 1901-1915 inclusive, led to the following recommendations with regard to the advisable manurial applications to be made to the flax crops per statute acre. 1) On soils in good condition, 1-1 ½ cwt. muriate of potash or 4-5 cwt. kainit; 2) on poor or medium soils 1-1 ½ cwt.. muriate of potash or 4-5 cwt. kainit and ½ cwt. sulphate of ammonia. In the second case, the mixtures of potassic manures and sulphate of ammonia should be applied a short time prior to sowing the crop.

In 1917, trials were carried out at three centres to compare the results obtained from ground rock (containing about 5 % potash), with those from sulphate of potash. The first was applied at rates of 10 cwt, 1 ton and 5 tons per statute acre respectively both singly and in combination with lime. The results of these trials afforded no evidence that dressings of ground rock containing potash would serve as a substitute for dressings of the ordinary soluble potash manures.

In 1919, trials were carried out at 5 centres in which kelp, flue dust. muriate of potash, and sulphate of ammonia + muriate of potash were compared as top dressings for flax. Each of the dressings of potash manures used was equivalent in potash content to a dressing of 1 cwt. per statute acre of muriate of potash containing 50 % potash. The variety of seed used was Dutch, showing a germination % of 95. This was sown at the rate of 54 qts., per statute acre. Results showed that the brairds on the unmanured plots were severely affected with yellowing, but no trace of this disease was observed on any other plots dressed either with muriate of potash or kelp. Where flue dust was used there was a slight touch of yellowing.

After deducting the cost of manures, the various manurial dressings gave the following profits per statute acre:

	£	s	d
Muriate of potash + sulphate of ammonia	12	6	8
Muriate of potash	8	17	5
Kelp	8	4	0
Flue dust	1	15	7

II. — SEED TRIALS 1915-19. — In addition to Dutch, Russian and Irish, the varieties of seed of the fibre variety tested included British-East African, Canadian (Ontario), Canadian Western Fibre, Canadian Riga Child (Prov. Saskatchewan), Dutch (White Flowering), English, French, Scottish, and United States seed. The following seed varieties of flax were also tested; Minnesota 25, Canadian Common and Argentine; but none of these gave results that would warrant their being recommended for sowing for fibre purposes. Dutch seed was included in each set of trials each year for comparison purposes.

The variety tests were carried out on different classes of soils, and the results obtained, taken in conjunction with those of previous years, affords conclusive proof that no special variety is specially suitable for a particular class of soil. The relative merits of the various kinds of seed varied from year to year. The largest monetary return was obtained from English seed in 4 of the 5 years trials. Of the Dutch varieties, the white flowering var. gave substantially the largest in 2 of the years and slightly lower than the blue flowering var. in the 3rd. year. The white var. produced taller and slightly more branched flax, and was about 10 days later in ripening than blue. Neither the French nor the U. S. A. seed gave as good results as the Dutch.

Pure line seed trials were carried out in 1919. The Department's Pure lines Nos. 3 and 5 showed a striking uniformity of flax straw compared with that grown from any of the commercial varieties, and from these results it is clearly evident that the flax crop can be greatly improved through the propagation of pure line seed from single selected plants.

291 - **Susceptibility of Flax to Lime.** — LIECHTI, P. and TRUNINGER, E. (Mitteilung aus der schweizerischen agrikultur chemischen Anstalt, Bern), in the *Deutsch. Landw. Presse*, Year 47, No 9, p. 65, 1 fig. Berlin, 1920

Experiments carried out in triplicate at the Agricultural Station of Liebefeld, Berne, Switzerland with a sandy clay soil, poor in lime. The pots used each contained 5 kg. of soil, and were dressed before and during sowing with a nitro-phospho-potassic fertiliser. Shortly before sowing, one series of pots was limed at the rate of 20 to 80 quintals of CaO per hectare in the form of powdered, or coarse 2 mm. lumps carbonate of lime. The other series received no lime.

Seventeen days after the flax was sown, this operation being effected at the same date in the case of all the pots, the plants in the limed pots began to grow less vigorously, the seedlings suffering in proportion to the amount of lime present. The chlorosis previously recorded by FISCHER was not observed but, on the contrary, there was a larger accumulation of chlorophyll. The addition of lime had also the effect of retarding flowering, and the largest amount of lime prevented fructification and induced apical necrosis.

Yields obtained from each experiment with 3 pots.

CaO per ha. quintals	Dry matter of the crop Without Ca O gm.	 Fine lime gm.	 Coarse lime gm.	No. of seeds gathered
0	90.7	—	—	285
20	—	56 1	—	5
80	—	30.8	—	0
20	—	—	87.3	289
80	—	—	79.5	80

The authors believe that the specific action of a dressing which, like lime, has an alkaline physiological reaction, has something to do with this phenomenon : this would agree with the results obtained by KLEBERGER, FISCHER, KUHNERT and HILMER. According to FISCHER, the addition of potassic salts may neutralise the injurious effect of the lime. The authors explain this beneficial effect of potassic fertilisers, as being due to their acid physiological reaction ; they explain the stimulating effect of plaster (gypsum) in the same manner, but state that they are unable to give the ultimate physiological reasons of the curious behaviour of the flax (1).

292 - **" Silver Wattle" Gum, Obtained from *Acacia Rivalis*.** — ANDREW, H. W. in *The Journal of the Department of Agriculture of South Australia*, Vol. XXIV, No. 3, pp. 207-209 Adelaide, October 1920

The author observes that although this acacia has been known commercially for a good number of years, no previous record in Australian literature is to be found as to the distribution or botanical name of the tree from which the gum is derived. On examination of the tree indicated as giving the gum, the author identified it as *Acacia rivalis*, which has a distinct affinity to *A. leprosa*, Sieb. var. *tenuifolia* Benth, in the flowers and bracts, and with the narrow forms of *A. stricta*, Willd. in the phyllodes and general appearance, but the flowers and pods are totally different, the latter a good deal like those of *A. calamifolia*.

Production of gum varies very much according to the climatic conditions of the gumming season, which usually begins in January; 4-14 tons are said to be produced annually in the Blinman district of S. Australia. Examination showed that the gum distinctly resembles in appearance gum arabic obtained from *Acacia senegal*, varying from light yellow to a cherry red, frosted on the surface. Another local trade name for the gum is " first light grade gum. " Supplies come chiefly from the district mentioned, but the author suggests that a definite mapping out of the region covered by this tree which appears to be peculiar to this part of Australia, might be undertaken with advantage.

293 - **American Storax Production: Result of Different Methods of Tapping Red Gum Trees (*Liquidambar styraciflua* L.).** — GERRY, E (Microscopist, Forest Products, Laboratory, Madison, Wis.), in *Journal of Forestry*, Vol XIX, No. 1, pp. 15-24, figs. 4. Washington, D C., January 1921.

Experiments were carried out in Louisiana to compare three different methods of obtaining gum from *Liquidambar styraciflua* L., a gum which should prove equally satisfactory for commercial purposes as that obtained from *L. orientalis* Mill. In May, 1919 ten trees were " deadened " or girdled by removing a strip of bark several inches wide from the entire circumference of the tree, 20 were tapped perpendicularly, and 20 were tapped horizontally.

The largest yield of storax after 8 tappings was obtained by horizontal tapping, and was secured during the hot August weather. The following shows the varying amounts obtained by the different methods :

	Perpendicular taps	Horizontal taps	Deadened
	grams.	grams.	grams.
Total storax	809.5	1456.8	428.5
Average per tree	40.5	72.8	42.8

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(1) The susceptibility of flax and other plants to lime has also been shown by recent experiments made in America. Cf. *R* Jan. 1919, No. 10. (*Ed.*)

Specimens were selected for microscopic study in the Forest Products Laboratory, and represented examples of the effects produced by these methods of tapping. The results agreed with those derived from field experiments. The gum and gum ducts apparently do not form in sufficient abundance, if the tree is " deadened ", to produce a high yield. The same reason holds good with the perpendicular tapping. The horizontal method stimulated the formation of wood and gum ducts, and promised a means of easily obtaining sustained yields, by freshening the chipping once or more each year, removing a $^1/_4$ to $\frac{1}{2}$ inch chip, where the production of gum is characteristically more abundant. The cut should be only deep enough to expose completely the surface of the last formed wood, and it is suggested that about $^1/_3$ of the circumference should be covered with the uncut bark. Necessary precautions must be taken to check the entrance of decay through exposed wood.

The author considers that according to the information now at hand, and taking everything into account, cutting the wounds on the gum trees early, say in February or March, would be an experiment well worth trying.

294 – **The Camphor Laurel and its Products.** — PERROT E. and Mme GATIN V., in the *Ministère du Commerce et de l'Industrie, Travaux de l'Office National des Matières premières végétales pour la Droguerie, la Pharmacie, la Distillerie et la Parfumerie*, Notice No 4, pp. 60 + 9 figs., bibliography of 41 works. Paris, July 1920.

In the first chapter the authors deal with:

(*A*) Characteristics and utilisation of the products of the camphor laurel (*Laurus Camphora L.* = *Cinnamomum Camphora.* Nees and Eberm. = *Camphora officinalis* Nees) : — Camphor, crude oil of camphor, white oil of camphor, red and black oil of camphor, safrol and light heavy and blue oils of camphor.

(*B*) Production of and trade in camphor and oil of camphor (1). In the second chapter the authors deal with the geographical distribution of câmphor and state that *Cinnamomum Camphora* lives to be 2000 years old and attains enormous girth ; the trunks of some specimens in China and Japan were 5-7 metres in diameter. In Japan, Formosa, and Tonkin two varieties of camphor tree are known, one with green and the other with red branches. Some authors describe them as different species but EBERHARDT found green and red branches on the same tree ; some yield camphor and others camphor oil without there being any relation to their colour. EBERHARDT considers that the nature of the product is related to the histological differentiation of the tissues; when the oil is dominant, it is due to insufficient lignification.

The species which most nearly approach *C. Camphora* are : *C. Parthenoxylon* Meissn, *C. Balansae* Lecomte, *C. ilicoides* A. Chev. and *C. Simondii* Lecomte. The leaves of these different species are very similar, but when rubbed they give off different perfumes. The inflorescences and fruits also possess many common characterics. Like the camphor tree these species, produce, in October and November, seeds, which germinate easily. In Indo-China, there are *C Camphora* and another *Cinnamomum* which has been identified by DUBARD as *C. cecidodaphnae* var. *canifora,* also a camphoriferous species.

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(1) See *R.*, May, 1920. No. 528. (*Ed.*)

The camphor tree prospers in all countries where the rainy season is well marked, on the banks of rivers, and on mountain slopes up to an altitude of 2000 metres. It is not very exacting as regards soil, but prefers a sandy-clay soil that is light and well drained.

In chapter III. The authors deal with:

1) The camphor industry (exploitation of the camphor tree in Japan and China, distillation, refining and conservation of the refined camphor).

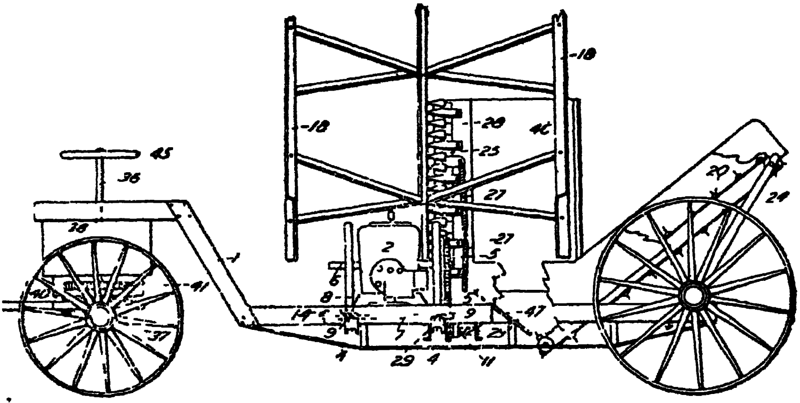

FIG 1 — Side view of a camphor harvester.

2) Experiments on the distillation of camphor leaves. They quote the work of HOOD & TRUE, GIGLIOLI, TARBOURIECH, EATON, KOZLOV, etc. All those who have dealt with camphor agree that the leaves yield enough camphor (about 1 %) to make the cultivation of the camphor tree on a large scale profitable, by yielding camphor more cheaply than the Japanese product.

Chapter IV deals with the cultivation of the camphor tree:

1) Experiments on the introduction and cultivation of the trees in different countries.

2) Choice and preparation of the soil (cultivation is possible in all soils, except in low-lying soils that are inundated during part of the year). The best soils are rich and well drained; the soil must be ploughed deeply before planting the seedlings.

3) and (4) Propagation by seed, slips and layers.

5) Final plantation.

6) Leaf crop and yield in crude camphor.

7) Machine for harvesting the leaves and branches.
8) Yield in leaves and crude camphor.
9) Parasites of the camphor tree.

The harvester mentioned above is an American machine, drawn by mules or a motor, and the authors give the following description of it:

1) A truck whose iron platform supports the cutter.
2) An internal-combustion engine placed on the platform.
3) A cutting device comprising a cutting blade carrying the reaping hooks, and a winch, the whole supported by springs so as to diminish vibration.

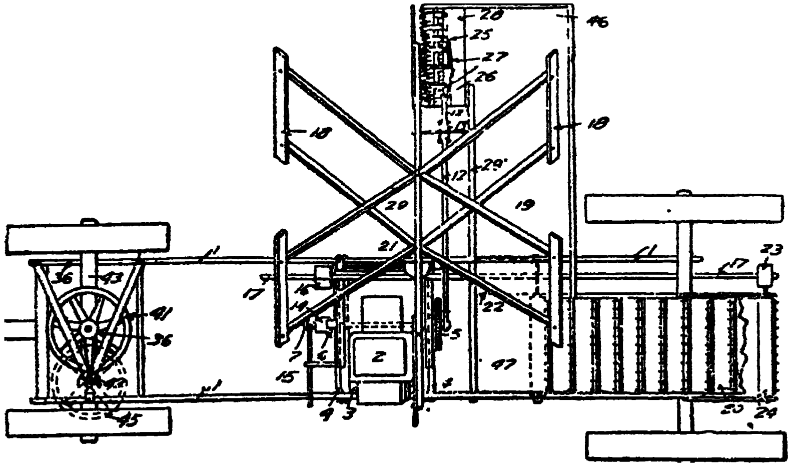

Fig. 2. — Elevation of a camphor harvester.

4) A cutting blade held rigidly at the proper cutting angle, furnished with knives or reaping hooks and connected to the engine and to the winch.

5) A reel to remove the twigs and leaves that fall between the knives.

6) A platform for collecting the crop in a sack which can be fastened behind the truck. This machine is not difficult to handle. Three men are necessary when mules are used, but only two men when a tractor is used.

The angle and cutting line being fixed the machine functions as follows;

The engine is started which starts the cutters moving, and the clutch operating the reel and platform is engaged.

The driver and the operator direct the machine according to the line to be cut, using the eye as a guide. The reel moving at a certain speed engages the young shoots between the cutters and at the same time the force of the blow given by the reel throws the parts of the trees cut by the cutters on to a platform placed at the base of the knife beam. The leaves and small branches are gathered by the moving platform whence they are carried into a bag.

A second platform, operating at right angles to the first, gathers the cut materials and places them in a receptacle for transport to the distillery.

Chapter V deals with the chemical composition of camphor and oil of camphor, the percentage of camphor in the oil, and substitutes for camphor.

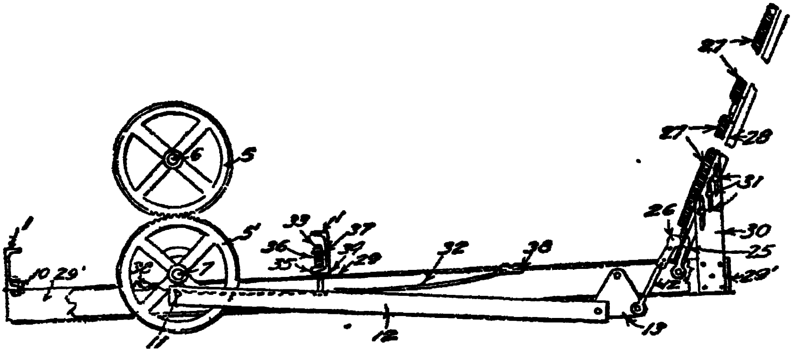

FIG. 3. — Transmission of power from engine to cutter blades.

In chapter VI the authors summarise the most important work that has been done on the formation and distribution of the camphor-secreting cells in the plant. Camphor is an oxidation product of an oil localised in special secreting cells distributed throughout the tree. The root possesses them especially in the cortical parenchyma; in the stem, they are found in the bark, the medulla, the woody parenchyma and the medullary rays. The autumn wood is richer than the spring wood. In the leaves these cells are located in the palisade and lacunose tissue. The petioles are extremely rich in the secretive cells, which are also found in the bud scales. In chapter VII, the authors study synthetic camphor and in the VIIIth and last chapter they summarise the history of the drug and deal with the therapeutics of camphor.

295 – **The Question of the Distance between Sugar Cane Rows.** — ROSENFELD A. H., in *The International Sugar Journal*, Vol XXII, Nos. 262-263, pp. 558-565, and 629-635, tables XVII. London, Oct.-Nov. 1920.

Report of the various investigations made in connection with the spacing of sugar cane plants with a view to allowing each plant to obtain its maximum development. The experiments reported were conducted in Louisiana, U. S. A., Hawai, Cuba, Guadeloupe, Java and at Tucuman, in the Argentine. Rows were spaced at varying distances of from 3-8 ft, and records kept of the average yield of canes per hectare, of the quantity and value of the sugar obtained, and of the comparative financial advantages of each method employed.

From this extensive survey of experiments made all over the world, the author states that it may be safely concluded that sugar should be planted in rows as close together as is consistent with proper cultivation with modern machinery, this distance appearing to be about 5 ft. for the thicker types of cane such as Cheribon, Lahaina, B 208 etc., and from 5 ½ to 6 ft. for the more abundantly suckering types such as the Java canes, the Uba, and the Japanese bamboo type, etc.

296 - **Studies in Mustard Seed and Substitutes. — I. Chinese Colza *(Brassica Campestris Chinoleifera.* Viehoever)** (1). — VIEHOEVER A., CLEVENGER J. F., and EWING, C. O. (Bureau of Chemistry, United States Department of Agriculture), in *Journal of Agricultural Research*. Vol. XX, No. 2, pp. 117-139, Pl 10, tables 6, bibliogr. of 52 works. Washington, D C, Oct 15, 1920.

Shortly after the outbreak of war, mustard seed which previously could be obtained from European countries was no longer available, and it was necessary to seek other sources of supply, but in some cases the seed offered as mustard was quite different not only in quality, but also in general appearance and condimental character. Material imported as rape seed and sold as mustard seed was identified as Chinese colza, *Brassica campestris chinoleifera* Vichoever. n. var.

Studies were undertaken to determine the macroscopic and microscopic characteristics of the seeds, as well as the chemical composition and certain physiological characteristics of the volatile oil. Plants were also grown to maturity, and the characteristics at the different stages of growth were determined. These experiments were correlated with data in literature dealing with the subject, and as a result the seeds were identified as those of Chinese colza. The authors add that this was previously classified as *Brassica campestris chinensis oleifera*, n. f., but was changed to its present name to avoid the use of a polynomial. The volatile oil obtained was identified as crotonyl isothiocyanate, which is not a suitable substitute for mustard oil, in respect to condimental, bactericidal, or medicinal value. The fixed oil proved to be of the general composition of the rape oils, and the quantity of the oil present, amounting to more than 40 %, characterised the seed as a very valuable oil seed.

On the basis of the general composition of the seed and the character of the volatile oil, it is suggested that the pressed oil cake may well be used as a stock feed. The leaves are succulent and should be valuable as a vegetable food. The plants, which are very vigorous and apparently hardy, seem to offer possibilities as a forage crop. Experiments along this line have been undertaken in co-operation with the Bureau of Plant Industry.

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(1) See *R* January 1921, No. 61. (*Ed*)

297 - **Tobacco Growing in Western Australia: — Notes for Intending Planters.** — *Department of Agriculture, Fruit Industries Branch, Bulletin* No. 74, pp 3-8. Perth, 1920.

The Tobacco Expert of the Department of Agriculture of Victoria, from whom the information contained in these notes has been obtained, states that sandy or shaly soil is best suited for the production of bright tobacco. The less clay, the better the quality of the leaf Heavy soils containing a proportion of clay, are suitable for the production of heavy, dark types which return a lower price but give big yields per acre. Soils which become waterlogged are unsuitable and good drainage is essential.

Moderate rain with warm weather is the best general condition. Dry weather during the ripening stages preserves the products required for aroma in tobacco, and dews in autumn also have a good effect on the leaf. Water should never be applied after the plants are topped, as it is then liable to affect them detrimentally during curing.

Varieties recommended are as follows: —

On light sandy soil, for cigarette leaf: — Little Orinoco, Yellow Pryor, Bonanza, Hyco and Granville Yellow.

On rich river flats — for pipe tobacco: — Medley Pryor, Blue Pryor and Lax.

On red chocolate soil for pipe tobacco. — Hestor and Conqueror.

On soil from 70 % to 90 % sand, — for cigar tobacco. — Connecticut seed leaf, Havana and Comstock. (Either regular rainfall or irrigation is necessary to grow the plants when the sand percentage is high, and the leaf texture very fine).

On red chocolate loam or strong sandy loam, — for cigar tobacco, — Vuelta de Abajo, Comstock and Pennsylvania.

One ounce of seed will provide sufficient plant for from 7-10 acres of heavy tobacco; and 2-4 acres of cigar tobacco, the latter being planted closer in the field to obtain a better texture; 1 oz. will be required to plant a bed having an area of 50 sq. yds. It is advisable before sowing to mix with about 20 times its own bulk of sifted wood ashes, dry sand or bone meal.

Conservation of moisture is an important factor during the growth of plants, until they become too large to admit of being worked between.

The following formula for fertilising poor soil per acre is given: — 300 lb. of lime, 200 lb. sulphate of potash (muriate of potash not to be used), 100 lb. of bonedust, and 1½ cwt. red blood.; the lime to be applied in the autumn, and the rest to be spread broadcast just before planting, and harrowed in.

It is advised to avoid cutting directly after rain and in the early morning.

After thorough curing, stripping and classification, processes all described in detail, and after the tobacco is again hung in the shed, it should be kept in sweet condition until the spring by the use of fires or ventilation, and the shed kept darkened. The next procedure, namely bulking, is advised when the midrib will crack $^2/_3$ of the way up the leaf, and when the leaves on being squeezed together in the hand, will open of their own accord when released. The fermentation of cigar leaf is a much more scientific process than that for heavier types of tobacco, and new growers are not advised to attempt it, but rather, to sell the leaf to the manufacturers as soon as the curing in the shed is completed.

The maximum amount of moisture required for safety before packing is from 10 to 12 %. The usual custom in Victoria is to pack the tobacco for market in bales, containing from 150 to 250 lb., made of hessian.

298 - **Grafting in India.** — I. PRAYAG, S. H., The Influence of Stock and Scion and their Relation to one another, in *The Agricultural Journal of India*, Vol. XV, Pt V, pp. 533-542, figs. 2. Calcutta and London, Sept 1920 — II. BURNS, W. and JOSHI, P. G., "Top-Working" of Indian Fruit-Trees, *Ibidem*, pp. 516-520, pl 3, Sept 1920.

I. — The author states that although much has been written regarding this subject, the fruits dealt with are unsuitable to Western India In this article it was intended to put together all the available material dealing with some important fruit trees and other plants with a view to inviting suggestions and criticism.

In order to ascertain the best stock on which to bud any variety of orange, pumelo, lemon etc., trials were made in the Ganeshkind Botanical Gardens since 1909 in which all the available varieties of *Citrus* in the Deccan were budded on the following stocks:— "Mahalunga" (*Citrus medica*,proper) "Jamberi" (*Citrus medica* var.), orange and "Reshmi" orange (*Citrus Aurantium*). The following results were obtained.— Scions of hardier varieties with thick bark from large round stems did well on *Citrus medica* but the "Jamberi" (*C. medica* var.), is preferable as a stock plant. The bark is mucilaginous and separates more easily from the wood below than that of Mahalunga and the plants showed a decidedly superior quality both in height and appearance to those on other stocks. It is well known that certain stocks have a very pronounced effect upon the habit of growth of the scion. *e. g. Crescentia alata* grafted on *C. Cujete* gives plants very dwarf in size. A similar result is obtained with apples on Paradise or dwarf stock (*Pyrus praecox*).

Experiments made by the author with grafts of " neem " (*Azadirachta indica*) on " bakan " (*Melia Azedarach*) showed that the formation of a big knotty excrescence takes place at the grafting juncture, owing to the different rate of growth of the two plants and the growth is thereby considerably checked. This check in the flow of sap due to the difference in the period of activity of stock and scion with consequent disaster was also demonstrated in experiments with *Ficus carica* on *F. glomerata*, and *Ipomoea Horsfalliae* on *I. carnea*.

The scion has a preponderating influence in producing its own quality of fruit. That the position of the mature scion at the end of a branch in a big tree does influence the flowering has been proved by experiments in various districts with the mango tree. Results are however, still inconclusive, but the question has an important practical bearing, as, if early flowering is induced on young transferred branches, considerable saving of time would be assured, and such plants as hybrid and polyembryonic mangoes, seedless guavas. etc. would be forced to reveal their characters at an early date.

The insertion of more than one variety on the branches of a single stock has been found undesirable.

In order to determine the influence of stocks and scions of different genera but belonging to the same natural order, the author conducted experiments with the N. O. Anacardiaceae. Grafting between different genera in this case met with failure.

II. — The author believes that the experiments here mentioned are the first of their kind in India, although the method of " top working " (renovation of the whole of the top of the tree by inserting scions in the existing branches and arranging that these scions grow while the old branches of the tree are removed), has been employed elsewhere.

Two obvious advantages of this methods were: 1) The top of the tree is not entirely removed which is an unavoidable necessity with crown-grafting;— 2) The scion is not taken away from its original water connections until the new are fully established, being attached to its own original plant until union occurs.

The following is an example of experimental trials:— A country mango tree in Bassein, near Bombay, of unknown age was heavily cut back on March 6, 1912. Many new shoots sprang up from the stumps and on these were grafted scions of good varieties on May 22, by inarching from plants in small pots tied to the tree in various places. On November 1, further grafting was done from the now established scions on to new shoots of the stock. Out of a total of 40 scions, 3 flowered in June 1914. It was apparent that by top working, flowers can be got 14 to 20 months after operation. The pot plants from which these scions were taken, did not flower. The first real crop was obtained from the tree in June 1916. There were 38 fruits of 4 varieties and these all retained their own characters although grafted on the same stock plant.

Top-working was also done with considerable success on wild trees and can be applied advantageously for the conversion of useless wild trees into good bearing trees. *Mimusops hexandra* can be top worked with scions of *Achras sapota* (the sapodilla plum or " chiku ").

Another application of top-working is in the starting of new mango plantations. The author advises the planting of the seeds of the stock plants in the field where the tree is wanted and afterwards to graft on to the stock when sufficiently grown.

Similar results with the so-called seedling inarch method of propagation have been got in America (*U. S. Bureau of Plant Industry, Bulletin* 202) with mango, mangosteen (*Garcinia mangostana*) and litchi (*Litchi chinensis*) etc.

299 - **The Banana Industry of the Honduras Republic.** — *The Board of Trade Journal*, Vol. CIII, No. 1194, p. 482 London, 1919.

Honduras, of all Central American countries, probably offers the best prospects for the cultivation of bananas, and it is possibly the only remaining country possessing reserves of land suitable for the industry. For the last twenty years the cultivation of this fruit has been actively followed all along the Atlantic coast, from the Mexican Gulf to the mouth of the Magdalena.

High winds and floods have caused considerable destruction, and a disease — the origin of which has not yet been ascertained — has done considerable damage to the estates. As a result of this disease plantations in Colombia, Costa Rica and Jamaica are practically on the road to ruin, none of the known remedies having succeeded in rooting out the evil.

Honduras is one of the oldest banana-producing countries, some plantations, twenty years of age, still producing fruit in abundance The banana lands on the coast are formed by layers of soil deposited by the watercourses, which during the yearly period of floods inundate the surrounding country, and thus act as a fertiliser. Truly alluvial soil exists in the valleys of the Chamelecon and Ullua rivers, which owing to their length, volume of water, and swiftness of current, cause at the season of floods, a more extensive inundation and retention of water, leaving deposits of rich soil.

Although Honduras may not possess a population in comparison with its area, there is no shortage of labour. The inhabitants of the interior have been attracted by the high wages offered by the American companies, and, in addition to labour already available, it is customary to send recruiting agents into the interior. Women and children are not in the habit of working on the coast plantations

As a result of war conditions, combined with the floods and disease, the enormous requirements of the American market have not yet been met, and so long as a company is able to supply its own means of maritime transport, there is little doubt that Honduras offers a very favourable field for enterprise.

300 - **Poultry-Keeping in Fruit Plantations.** — See No. 325 of this *Review*

301 - **Vine Growing in the State of Rio Grande do Sul, Brazil.** — Esquier, L. in *Brasil agricola*, Vol V, No 10, pp. 301-302. Rio Janeiro October, 1920.

The soil of Rio Grande do Sul is excellent for vine-growing and there are already 30 000 hectares under vines in the State, 900 000 hectolitres of wine being produced yearly. The vineyards are mostly situated in the mountain districts, in the neighbourhood of Caxias, Garibaldi, Bento Gonçalves, Alfredo Chaves, Antonio Prado and Guaporé, where the soil is a strong, stiff, sandy clay.

The climate resembles that of Southern Europe, mean temperature in spring and autumn being from 16°C to 17°C, whilst it is 22°C in summer. The winter temperature is sufficiently low to allow vegetation to rest. There are, however, two serious drawbacks, viz., frequent spring frosts, and the heavy rains during the growing period of the vine. These encourage the spread of fungoid diseases (anthracnosis, mildew) to an unusual extent

According to data collected by the Caxias meteorological Station, there were 146 wet days in 1914, the total rainfall during that period being 2914 mm.; half of this amount fell during the vegetative period of the vine.

In Rio Grande do Sul, American vines, varieties or hybrids of *Vitis Labrusca* or of *Vitis aestivalis* (Isabella, Clinton, and Herbemont) are chiefly grown: they produce grapes of mediocre quality. A few European varieties are, however, also cultivated.

The vines are usually grown on trellises; pruning is done without any method, and the soil is never ploughed; therefore there is much room for improvement, As a rule, the grapes are made into wine by the cultivator, whose methods and apparatus are alike primitive.

At Caxias, there is a well established Co-operative Wine Society, which exported, during the first half of 1920, some 5000 hectolitres of wine. Another similar society exists at Bento Gonçalves.

Phylloxera has been reported from all the territory of the municipality of Garibaldi, and is slowly spreading. M. ESQUIER therefore advises the introduction of more resistant stocks than those at present cultivated. He suggests as varieties suitable to the climate, Riparia Grande Glabre, Riparia Gloire de Montpellier, and hybrids of Riparia × Rupestris Nos. 3306, 3307, 3308 and 3309. As grafting varieties he advises Malbec, Pinot, Carignan, Cinsault, Grand Noir, Aramon, Clairette, and white Urgni. M. ESQUIER also advocates the trial of the hybrid direct bearers Couderc 7120, Seibel 1000 and Gaillard 157.

In conclusion he advises the establishment at Caxias, of a viticultural and Oenological Experiment Station.

302 – **Vines of Trentino: the Teroldigo and Negrara Varieties.** — DALMASSO, C., in *L'Italia agricola*, Year LVIII, No. 1, pp 5-7, 1 fig, 1 coloured plate, No 2, pp. 49-50. Piacenza, January 15–February 15, 1921.

I. THE TEROLDIGO VINE. — The author draws attention to this vine which is one of the most important in the Trentino, though it is not to be found in any of the Italian or French Ampelographies. ACERBI alone (*Delle viti italiane*, Milano, Silvestri, 1825) mentions, in the Catalogue of Italian and foreign vines cultivated in his vineyard near Castelgoffredo, among the vines from the neighbourhood of Trent a " Teroldega maggiore " and a " Teroldega minore " This very laconic description was copied by ROVASENDA (*Saggio di un Ampelografia universale*, Turin, S. Marino 1879) and, later, by CAVAZZZA (*Viticoltura*, " Nuova Enciclopedia agraria italiana ", Turin, U. T. E. T., 1914), and by VIALA and VERMOREL (Ampelographie, Masson, 1909).

On the other hand, a succinct description has been given by German students of the vine, beginning with GOETHE (*Ampelographisches Worterbuch*, Vienna, Faesy and Frick, 1876; *Handbuch der Ampelographie*, Graz, Leykam, 1878), and later, by BABO and MACH (*Handbuch des Weinbaues und der Kellerwirtschaft*, Berlin, P. Parey, 1909).

For this reason, the author thinks it advisable to give further details concerning this vine.

Synonymy. — It has no true synonyms, although its name has been more or less altered into "teroldico", "teroldego" and "teroldega". Sometimes it is called "trellinger" in the Upper-Adige, which, according to Goethe, is wrong, this being the name of a quite different vine ("Frankenthal" or "Schiavone"). From Acerbis' catalogue, it might be supposed that there were two varieties of "teroldigo"; the author has, however, never found more than one.

Localities where it is cultivated. — The original home of this vine is not known for certain. At the present time, it is grown almost exclusively in the plain of Mezolombardo (Valley of the Adige), which includes the Communes of Mezolombardo, Mezocorona, S. Michele and Grumo.

Ampelographical Description. — Vigorous grower, although inferior in this respect to other Trentino vines.

Roots rather shallow.

Canes long and slender, reddish-brown in colour, slightly tinged with violet at the nodes, internodes average, cortex striated. Buds prominent.

Buds yellowish-green, covered with thick whitish down giving them a characteristic appearance in spring. Buds early.

Leaves of average size, tri-quinque lobed with shallow lateral groove, and petiolar groove nearly closed; upper surface dark-green, opaque; lower surface, light, thickly covered with hairs; mucronate, teeth fine, veins yellowish. Petiole of average length, violet-pink, tomentose. The lamina turns red at the time of vintage. Leaf-fall somewhat early.

Bunches of average size, pyramidal in shape, rarely cylindrical (only where two bunches grow on adjacent nodes), generally winged (with one or two wings), somewhat compact: Peduncle rather long and strong; pedicels short and green; graft callus little noticeable; brush red; Grapes average sized, slightly ovoid, blackish-blue, with much bloom; skin very resistant, rich in colouring-matter and tannin; pulp juicy, flavour sweet, clean. Pips of average size, 2 or 3 in number at most.

Maturation at the 3rd period, but the grapes can remain fairly long on the vine without rotting.

Practical Information Respecting this Vine. — The "teroldigo" likes light, permeable, alluvial soils, and does not ripen well on heavy soils. When grown on fertile soil, its grapes are less characteristic.

Hence, the best soils are those of the old bed of the Noce, near the point where it joins the Adige.

As the base shoots do not bear grapes, the "teroldigo" vine must be pruned long. It is very well suited to the typical "pergola" system (trellises forming an arbour) of Trentino. Grown thus, it bears a heavy crop, more than 100 and sometimes as much as 200 hectolitres of pressed grapes.

The "teroldigo" is rather susceptible to mildew and oidium; it is still more liable to anthracnosis, and the attacks of *Tetranychus telarius* (very common in Trentino). This variety has much affinity with American vines and grafts well on most of them.

Practical Information Respecting the Wine. — The wine made from the grapes of the "teroldigo" is one of the favourite vintages of Trentino. When grown on good positions the grapes yield a must with a high sugar content, with, however, decided acidity (a rare character in Trentino vines). The 30 years' average sugar content of must made from grapes grown in the vineyards of the San Michele Agricultural Station was 19.2 % (BABO glucometer), the maximum being 23.4 %, the average acidity 7 per 1000, and the maximum 10.9 per 1000.

The wine made from the finest "teroldigo" grapes is excellent, full-bodied, rich in colouring matter and tannin, and possesses a special, very agreeable bouquet. When not allowed to ferment too long on the pomace, it can be used at once and, if properly aged, makes a good wine for bottling. Usually however, "teroldigo" is in request as a half-blending wine for transforming the local white wines into red table wines.

During the years preceding the war, "teroldigo" was also much appreciated in Germany and Switzerland, whither it was often exported in the condition of pressed grapes.

II. THE "NEGRARA" VARIETY. — SYNONYMY: In that part of Venetian Trentino where German is spoken, this vine goes by the names of "Edelschwarze" and "Salzen". It is chiefly known by the latter appellation at Meran.

AREA CULTIVATED. — This variety is much grown in Venetian Trentino, and especially in the Trentino properly so-called, viz., at Rovereto, Calliano, in the neighbourhood of Trent, at Lavis and at San Michele. Subsequently it also spread to the Upper-Adige and the Ueberetsch at Meran.

AMPELOGRAPHICAL DESCRIPTION. — *Canes* of average thickness, long, brownish-yellow in colour, with violet-red shades that are lighter in winter, finely striated; nodes somewhat swollen, internodes average or above the average; buds very prominent.

Buds green, glabrous, glossy, a little brown, but only at the extremities; covered with fine hairs. Budding average.

Leaves of average size, trilobate (rarely five lobed) with deep upper sinus which is rounded and closed, or nearly so. Sinus of petiole open, forming a U., upper surface dark-green, vesiculate; lower surface with slight silky down; large irregular teeth; veins very prominent on lower surface; has a slight violet tinge. Petiole small, short, pink. Leaf-fall average.

Bunches large or very large, rather long, pyramidal, winged (often with 4 wings) a little compact. Peduncle long and strong, semi-ligneous; pedicels of average length, green, a little verrucose, graft callus large, verrucose, violet; brush pink.

Grapes above average size or large, round (sometimes slightly flattened); colour very dark blue, very much covered with bloom, skin often resistant, pulp succulent; flavour clean, sweet, agreeable.

Pips of characteristic shape, beak long and inflated (much compressed at the chalaza); generally 2, rarely 3 in number

Maturation at the 3rd period, late.

PRACTICAL INFORMATION RESPECTING THIS VINE. — It requires light, warm soil, and as it grows best when exposed to the sun, is well suited to hills or slopes, but not to the plain. It is a vigorous grower, needing much pruning, and is therefore well adapted to the Trentino " pergole ".

Yield rather inconstant; when grown on its own roots, it fruits late, but is earlier if grafted. The yield also varies according to the soil, being less heavy on stony than on heavy soils; the quality, however, varies in an inverse manner. The average 20 years' production of the vineyards belonging to the San Michele Agricultural Institute was 55 hectolitres per hectare, with a maximum of 103 hectolitres.

This vine suffers much from oidium and *Tetranychus telarius* whereas it is very resistant to anthracnosis and cold. Does well on the chief stocks, although the grafts appear rather weakly in the nursery.

PRACTICAL INFORMATION RESPECTING THE WINE. — If grown in a good situation, the Negrara grapes produce a strong, rather highly-coloured wine with characteristic bouquet when bottled As a rule, the wine is of the ordinary table variety. At the Institute of San Michele, the average sugar content for 30 years (according to the BABO glucometer) was 17.3 %; sometimes it rose to 21 %, whilst the average acidity was 7 °/₀. Negrara grapes are often pressed with those of the Rossara and Schiave varieties, in order to obtain a good ordinary table wine.

303 - **Eucalypts Resistant to Heat and Drought, Observations made in Southern California.** — MUNNS, E. N. (Forest Examiner U. S. Forest Service), in *Journal of Forestry*, Vol. XIX, No. 1, pp. 25-33. tables 6, Washington, D. C., January 1921.

In June, 1917, at different stations in Southern California the mean temperatures averaged 3 to 4° above the monthly mean, the maximums were 10 to 15° above the normal and ranged from 100 to 124°F. The effect of these trying conditions upon all plant life was very noticeable, and the drought affected the eucalypts also to a marked extent, especially the foliage. The character of the soil indicated by the moisture equivalent, influenced the amount of damage to a striking degree. On sandy soils, the damage was far greater that on any other kind of soil. The author indicates for a number of places where plantations were inspected, the species, nature of soil, and the character of the injury. The following table shows the percentage of trees injured, based on the general soil types.

Soil type	No of trees basis	Trees killed	Percentage of trees insured				
			All leaves killed	Partial loss of foliage			
				over 50 %	10 to 50 %	Under 10 %	No damage
Sand	7 288	18	21	16	19	28	16
Sandy loam	5 116	—	—	1	8	30	61
Loam	1 982		—	—	—	18	82
Clay loam	2 109	1	6	11	37	40	6
Clay	334	—	13	11	29	31	16

From general observation, eucalypts can apparently withstand drought if planted in loamy soils or where the trees are able to reach the permanent ground water. Of the species noted, taking into account the conditions to which they were subjected, the age of the trees, and their treatment, 2 species *E rostrata* and *E. tereticornis* appear to be the best for planting in regions of high temperature and high evaporation These make the most rapid growth and under the severest conditions, withstanding both low and high temperatures, and are more adaptable than other important species to wide ranges of soil and site conditions

304 - **Experiments on the Value of Common Rock Salt and Sulphur for Killing Live Stumps of Trees.** — RUDOLFS, W, in *Soil Science*, Vol IX, No. 3, pp 181-186 pl 2. Baltimore, M. D, March 1920.

The clearing of land in New Jersey, where great tracts of valuable land are covered with pine and oak wods is commonly accomplished both by the " suckering " method and with the help of goats To find a means whereby the clearing would be less costly, and whereby the land could be improved, possibly after 1 or 2 years, was the object of the experiments here reported. These were carried out under somewhat different climatic and soil conditions, the latter including swampy, and dry sandy soils, and a sandy loam

According to analyses made, the common rock salt employed, contained 97 to 98 % sodium chloride, a little magnesium chloride, and a few impurities. Results showed that this when applied to oak stumps which have been allowed to grow for several years, does not do much harm when applications of from 2 to 2 ½ tons per acre are given When applied in amounts of ½ to 1 ton per acre, these shrubs are stimulated, the salt acting as a fertiliser. In cases where trees have been cut in winter time and the brush burned on the premises the stumps are much retarded in their growth, by applications of salt at the rate of ½ to 1 ½ tons per acre Applications of 2 to 3 tons per acre will kill stumps of white and black oak, or cause eventual death The resistance of the stumps generally, after treatment with salt, was apparently in the order of oak, cherry, chestnut, dogwood, birch and maple The last was affected very easily

The best time to make applications is apparently the spring, just before the leaves appear, and when the sap stream is able to carry the chlorine to the buds and young leaves

Application of sulphur on high or low oak brush as a means of clearing land for agricultural purposes, was of no value Instead, sulphur seemed to have a stimulating effect upon the growth of live tree stumps

305 - **The Accuracy of the Different Cubing Methods Applied Comparatively to the Beech-tree in Italy.** — FERRARI, E, in *Le Stazioni Sperimentali agrarie italiane*, Vol LIII, Part 12, pp 505-514 Modena, 1920.

In order to determine the mass of the wood of 17 standing beech trees in the inalienable forest of Camaldoli, the author applied the following 7 methods, set forth in order of their accuracy

(1) By 1 metre sections (control) error $^0_0$	0.000 cubic metres
(2) With specimen trees classed diametrically, + error	2.73
(3) With the average coefficient, + error	3.02
(4) With diameter at $^1/_4$ and $^3/_4$ height, — error	3.94
(5) With specimen trees (URICH method), + error	5.17
(6) With average trees, — error	7.75
(7) With diameter ½ height, — error	11.78

The author thinks that the best method for deciduous woods is the mixed method, that is to say, the volume of stem that can be used is determined on the basis of the diameter half-way up obtained by the Camaldoli hypsodendrometer, and to estimate by the eye the rest of the wood which is to be used for making charcoal, tree by tree. No other method is successful because the amount of workable wood varies from tree to tree.

This is why it is necessary, for irregular, deciduous woods, to determine first of all the mass of the stem (up to the tip) by means of the abovementioned method, making use of the hypsodendrometer. It is necessary to increase the volume thus obtained by employing a fixed percentage (in the case in question 12 %) and then to judge by eye the percentages, tree by tree, comparing them with the volume of the stock utilisable for timber.

As an alternative it is possible to gauge the volume of utilisable wood in the trunk on the basis of the diameter half-way up with the hypsodendrometer, and then fix by eye *a priori*, in each tree the volume of trunk remaining and that of the branches to be used for charcoal. In order to make sure, the wood when cut should be measured per cubic metre when piled for making charcoal.

LIVESTOCK AND BREEDING

306 - **The Frequency of Latent Forms of Bovine Piroplasmosis in Morocco.** — BALOZET L., in the *Bulletin de la Société de Pathologie exotique*, Vol XIII, No. 9, pp. 733-734, 2 figs Paris, November 10, 1920.

The Moroccan form of bovine tuberculosis studied by VELU (*Bulletin de la Société de Pathologie exotique*, No. 8, 1915) is very common in the well watered regions at the foot of the Middle Atlas, where vegetation is luxuriant, and Ixodineae are especially numerous. The disease rarely attacks the cattle of those districts, and any cases that occur are of a benign type.

On the other hand, however, it very frequently affects with fatal consequences, animals imported from other parts of the country, and particularly those brought from the mountains.

The author made many examinations of the blood of apparently healthy cattle, and in 40 % of the cases, discovered the presence of piroplasmosis. The parasites are rare, only 1 in 5 to 10 fields. They occur in all the usual bacillus oval, annular or dot forms described by VELU and comparable to those assumed by *Theileria parva*, *T. mutans* or *T. annulata* and to the bacilliform piroplasms existing in Indo-China (SCHEIN), or Algeria (SOULIÉ and REIG).

Thus, the cattle of certain parts of Morocco may be permanent carriers of piroplasms, and can acquire an immunity, which appears strictly specific, to the hematozoa of the region. This immunity is relative, and may be lost in the case of weak and overworked animals

In cattle suffering from acute piroplasmosis, bigeminate pear-shaped forms associated with the shapes already mentioned, occur ; sometimes the former become very numerous, 20 % of the parasites being of this type. A similar association has been reported in Madras (CHRISTOPHERS), Japan (MIYAJIMA and SHIBAYAMA), and Indo-China (SCHEIN, " Observations sur la piroplasmose des bovidés de l'Indochine et constatation de piroplasmose chez les buffles ", *Annales de l'Institut Pasteur*, Vol XXII, No 12, p. 1005). The fact that bigeminate pear-shaped bacilli occur in the acute form of Moroccan piroplasmosis should be compared with the observations of SCHEIN, who found that, in cases of bacillary piroplasmosis in Indo-China, bigeminate pyriform bacilli appeared for a short time in the blood of animals inoculated with rinderpest, at the moment when the thermal reaction reached its maximum.

307 - **Aphthic Fever in Morocco.** — VELU H., in the *Bulletin de la Société de Pathologie exotique*, Vol. XIII, No 9, pp. 726-729. Paris, November 10, 1920

Aphthic fever (1) has long been known in Morocco, where it is called by the natives " Bou Jder ", or " Bou Jedri ", a generic term applied to all contagious eruptive diseases. It usually takes a benign form in ruminants, although twenty years ago, an outbreak of this malady apparently caused the death of a fairly large number of these animals

Cattle, when tired by the long trying journeys, under bad hygienic conditions, necessary to reach distant markets, or the port of shipment, always contract aphthic fever in a more serious form than animals remaining on the farm ; cases of death are not infrequent, while the convalescence of those cattle that recover is aways long. The same applies to the swine that are crowded together between decks on ships badly equipped for long voyages.

Though generally speaking such ruminants as are attacked by aphthic fever take a mild form of the disease, the present epidemic in Casablanca has caused a considerable decrease in the milk production of the herds of Spanish goats supplying the town with this commodity.

Young suckling animals have proved to be much more susceptible to the disease than adult stock and to succumb to it to a greater extent (2). The mortality among calves and goats is very high, the animals dying from septicaemic forms of the malady before the appearance of lesions in the mouth or feet.

In adult stock, the presence of aphthic fever is shown by unobtrusive lesions of the hoof causing very slight lameness for 3 or 4 days at the most, and by the typical lesions of the lips and tongue which give rise to a little anorexia, and to dysphagia lasting for 2 or 3 days.

(1) See *R.* Mar. 1920, No. 335 ; *R.* Sept. 1920, No. 882. (*Ed.*)

(2) See *R* Oct 1920, No. 1002. (*Ed*).

In swine the virus seems to have considerable pathogenic power. Adult animals (boars and nursing sows) only suffer from local lesions, usually of no great importance, in the mouth, teats and feet. In 1913, these foot-lesions were of a more serious nature, because the animals were out to grass. In young pigs, however, the disease occurs under very varied forms which, are often septicaemic and of exceptional severity.

(*a*) Buccal form with more on less confluent aphthic lesions on the lips, tongue, and gums

(*b*) Digital localisation with congestion of the ungual pad, aphthic lesions of the interdigital spaces, the detachment, necrosis, and very often loss of the hoof (in about 40 % of the cases).

(*c*) Digestive form with general serious symptoms and typical gastro-enteritic lesions.

(*d*) Pulmonary form with diffuse tracheo-bronchitis, and nucleus of pneumonia.

In all serious epidemics, the high mortality is to be attributed to cardiac lesions. A large number of young pigs, calves and even adult cattle die of cardiac syncope.

Death supervenes without any previous symptoms. The animals stop, appear agitated, sometimes a trembling or weakness of the hind-legs sets in, and they fall dead from heart-failure. Sometimes the cattle that succumb in this manner are in good general condition and their digital or buccal lesions are in a fair way to being cured.

Postmortem examination reveals a lesion described by KITT under the name of " spotted heart " (coeur tigré), which seems as typical as the aphthic lesion. It consists of parenchymatous, interstitial myocarditis, and microscopic investigation shows the existence of small, whitish striae, or dotted lines, or of more or less irregular zones The whole thickness of the myocardium is, however, not affected. The heart is always arrested, flaccid, in diastole.

In such cases, which are of common occurrence in young weaned pigs the treatment of the aphthic lesions is a secondary matter. What is of paramount importance, is a heart stimulant. The author has tried camphorated oil with very encouraging results.

308 - **Absorption of Aphthic Virus.** — VALLEE, H and CARRE, H , in the *Comptes Rendus de l'Académie des Sciences*, Vol CLXXII, No 3, pp. 185-187 Paris, January 17, 1921.

Researches made a long time ago on infectious anaemia in the horse and distemper in dogs, have enabled the authors to state, that filtrable viruses, like microbic toxins can adhere to the minute corpuscles in suspension in the supporting media. They have prosecuted their studies still further and found that the same power is possessed by the virus of aphthic fever. As absorbent substances the authors employed the blood corpuscles of oxen or bacteria, such as pneumococcus and staphylococcus.

They found experimentally that the aphthic virus adhering to the above-mentioned bodies is liable, under certain conditions, to total phagocytosis. Unfortunately a single inoculation with the absorbed virus is not sufficient to produce immunity.

The statements made in this paper show how careful the observer should be in inferring the presence of intra-globular virus in infections, unless during their course, the microscope clearly reveals the existence of an undoubtedly abnormal substance in the blood-corpuscles. The facts discovered make it possible to obtain, in the case of various diseases due to filtrable virus, phagocytosable suspension suitable for immunisation experiments, which it has hitherto been impossible to carry out. Finally under the same conditions, they will facilitate the preparation of sensitised viruses.

309 - **Immunity conferred by the Milk of Animals that have Recovered from Aphthic Fever.** — LEBAILLY, C., in the *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXIV, No. 4, pp. 180-181. Paris, January 29, 1912.

In the course of his reseatch on the properties of aphthic virus, the author inoculated some young six-week-old pigs, which had been born after the disappearance of the disease, on farms where aphthic fever had been rife 6 months before. In certain cases, the mother had suffered from aphthic fever during the gestation period; in others, she had remained wholly immune, the piggery having escaped the epidemic that had attacked the milch cows. The virulent substance inoculated was the citrated blood of cattle taken during the fever period at the time when the thermometer registered 41°C. The amount injected varied from 5 to 10 cc. (1 cc. being sufficient for the infection of a cow). Under these conditions, the author was unable to induce the disease artificially.

In the case of a litter of pigs remaining immune throughout the course of an outbreak of aphthic fever, the only possible explanation is that this immunity was conferred upon them by the milk they were given, and which came from cows that had recovered from the disease.

Hence, the experimental study of aphthic fever has become increasingly difficult, since in times of epidemic, not only animals that have remained immune must be used, but also such as have not been fed on milk with immunising properties. During aphthic fever, milk which has been the cause of contagion and loss of life during the fever period, becomes some days after the recovery of the animal producing it, a valuable specific for the prevention of the disease in the case of young animals, and perhaps also for the treatment of the malady.

310 - **Diseases of Livestock in Morocco.** — See No. 315 of this *Review*

311 - **Dermatoryctic Mange in Rabbits and Guinea-Pigs.** — BARDELLI P. C. (Institute of General Pathology of the University of Bologna), in *La Clinica veterinaria*, Year XLIV, Nos. 1-2, pp. 19-23, bibliography of 11 works, Milan, January 15-31, 1921.

All the authors are agreed that *Dermatoryctes mutans* Ehlers (synonyms *Sarcoptes mutans* Robin, *Knemidokoptes viviparus* Fürstenberg, *Sarcoptes avium* Gerlach) is a specific skin parasite of domestic and semi-domestic birds, and in particular, of fowls of distinct breeds, in which it causes a characteristic skin disease known as " scaly-leg ". The specific nature of the parasite has been generally admitted to the extent that in the classification of Acarids, the genus *Sarcoptes* has been divided into 2 sub-genera:— (1) Fusarcoptes or Sarcoptes properly so-called, parasitic on mammals; (2) Knemidokoptes or Dermatoryctes, parastic on birds.

In many cases, a species of mange proper to mammals has been known to attack birds, but there are no exact details of the inverse transmission.

This has, however, been reported, apparently for the first time, by the author who has observed the indirect passage of *Dermatoryctes mutans* from the foot of a fowl belonging to a common breed, to the skin of all the body of rabbits and guineas-pigs, except that covering the head and feet. The disease was transmitted by the basket in which the fowls were laying. One of them was put in it to sit, and later, the basket was occupied by the rabbits and guinea-pigs for one night and the greater part of the day.

Fowls are less easily infected than rabbits, being protected by their plumage, which is thicker and harder than the rabbit's fur, and by their coarser skin.

The disease easily yields to baths of weak solutions of sulphate of potassium (5 per 1000).

312 - **The Retention of Milk** (1). — PORCHER, C., in the *Comptes Rendus de l'Académie des Sciences*, Vol. CLXX, No. 16, pp. 963-965. Paris, 1920.

Experiments carried out by the author have shown that if the milk of a cow is retained in the udder, the lactose is re-absorbed, and is eliminated by the kidneys. Osmotic pressure is maintained in the udder by an increase in the amount of sodium chloride present. With the help of these facts, the author explains the abnormal composition of colostrum and of the milk secreted under certain pathological conditions.

313 - **Experimental Researches on Colostrum.** — PORCHER, CH. and PANISSET, L., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 3, pp. 181-183. Paris, January 17, 1921.

Colostrum contains, in addition to the fat globules which are the normal constituents of milk, certain muriform bodies, known as DONNÉ'S corpuscles. Investigators are far from being agreed as to their significance, but the researches of several workers tend to show that they are leucocytes filled with drops of fat. This has been confirmed by the experiments of the authors.

According to them, colostrum is a result of the phagocytosis of milk previously produced. They have experimentally brought about conditions corresponding to those obtaining in the case of intramammary retention, by injecting sterile milk into the peritoneum of a guinea-pig: the process by which the milk is attacked is the same in both cases.

The histological study of the peritoneal deposits resulting from the injection of the milk, has shown that some of the leucocytes are polynucleate and the others mononucleate. Both varieties have proved themselves capable of absorbing the fat globules of the injected milk. The most important part, however is played by the mononucleate leucocytes, which seem to be the agents of slow re-absorption and lasting protection.

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(1) See *R.* Jan. 1919, No. 79; *R.* Jan 1921, No. 73. (*Ed.*)

314 - **Reciprocal Relations Between the Nitrogenous Free Extract and the Crude Fibre in Fodders.** — HONCAMP, F., in *Fuhling's Landwirts Zeitun*, Year 69, Parts 19-20, p 378, Stuttgart, Oct 1920

The usual groups of chemical substances present in fodder, and known respectively as protein, fats and crude fibre, ash, and nitrogen-free extract are determined by the Weende Station method devised by HENNEBERG the last group being calculated by difference. This method, in spite of analytical imperfections, is, for practical reasons, always used, for as HENNEBERG states, in the case of fodders, the fraction of digestible fibre corresponds to the fraction of non-digestible extract, so that the simple determination of the nitrogen-free extract in a fodder would immediately give (with Weende method), the total quantity of extract and of digestible crude fibre present

This compensation law of HENNEBERG was at once greatly criticised; STOHMANN modified it by stating that the sum of the digestible nitrogen-free substances (especially in meadow hay) is almost equal to the amount of nitrogen-free extract and of the fats present but is influenced by the degree of the digestibility of the crude fibre.

The author's experiments show that HENNEBERG'S law of compensation does not always hold good, and further, that even STOHMANN'S amended version is not in every case true.

315 - **Stock Breeding in Morocco** (1). — MONOD, TH, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No 36, pp 873-879 Paris, December 1, 1921

Stock-rearing in Morocco is still almost entirely in the hands of the natives. Therefore, in order to increase and improve the domestic animals of the country, it is chiefly to the natives that the Stock Breeding Service must appeal. Its efforts in this direction are the subject of the author's paper.

The reasons that hindered the development of the Moroccan herds and flocks before France assumed the Protectorate of the country are as follows: 1) The prohibition of the export of stock; 2) insecurity and the frequent raids between the tribes; 3) ignorance of all hygienic breeding rules; 4) the mortality due to parasitic and contagious diseases.

1) The export of animals from Morocco is now permitted, as far as is possible without prejudicing the development of the flocks and herds. In 1920, it was limited to 50 000 cattle and 100 000 sheep. No limit was placed on the number of swine exported. As a matter of fact, the number of head exported was much less.

2) The pacification of the country has enabled the native to increase the numbers of his stock which have risen (in spite of the increased local

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(1) See *R.* March 1919, No 272; *R.* April 1919, No 413 (*Ed*)

consumption) from 672 483 cattle and 3 175 201 sheep in 1915, to 1 332 175 cattle and 5 079 629 sheep in 1919

3) A Service of gratuitous veterinary consultations has been organised. The Stock Breeding Inspectors make medical rounds frequenting the great regional markets, and installing themselves in some public place where they give advice, distribute medicines, and perform surgical operations. Their labours are completed by making a tour of the tribes, where the principal native proprietors are assembled in the tent of their chief.

With each of these Stock Breeding Inspectors are associated one or more native assistant veterinary surgeons recruited from the region where they will work.

In 1919, 37 220 consultations were held, and 15 000 ordinary operations and 17 754 castrations performed upon native stock. From January 1, 1921, only castrated animals will be allowed to be exported.

Great difficulties hàve been experienced in persuading the natives to provide suitable shelter for their beasts, some very encouraging results have, however, been obtained in this direction Any idea of providing reserves of food to tide over the dry season meets with stolid passive ressistance. The agricultural Hydraulic Service has already made great efforts to provide stock-rearing centres with the drinking-troughs necessary for watering the stock at all seasons of the year, but there is still a great deal to be done in this matter

(4) *Parasitic diseases.* — Parasitic cattle diseases such as echinococcosis, distomatosis, parasitic broncho-pneumonia, coccidiosis, scab, etc., are very common in Morocco, and it is exceptional for animals sent to the butcher not to have one or more of their organs affected As long as the pastures are luxuriant enough to provide the stock with sufficient food, these maladies do not greatly affect their general well-being, it is only in dry years, when the flocks and herds become thin, and therefore less resistant, that they fall victims to these diseases, but in such seasons, the mortality from these causes is often high. All that has hitherto been done is to seize and disinfect all affected organs in the abattoirs and slaughter-houses.

Contagious diseases. — Morocco, from the veterinary standpoint, is divided into a certain number of sanitary districts, each placed under the supervision of a veterinary inspector of the Stock Breeding Service.

The contagious maladies that levy the heaviest tribute upon the Moroccan flocks are bacterial anthrax, and symptomatic anthrax. A very active and incessant propaganda is carried on by the Stock Breeding Service, in order to induce both European and native owners to inoculate their animals as a preventive measure. Whereas in 1915, only 2000 animals were inoculated, the number rose to 26 825 in 1919, and since the beginning of 1920, it has attained to 69 180. A much higher figure is anticipated for 1921.

Scab is endemic among the Moroccan flocks, but is usually present in a benign form. All sheep intended for export are previously inoculated

A Research Laboratory for Stock Breeding has been founded at Casablanca. Each of the Inspectors of the Stock Breeding Service has a small laboratory at his disposal, where he can make the first bacterial diagnosis of any disease.

316 - **The Arab Horse and its Genetic Value** — BUSH-BROWN H. K., in *The Journal of Heredity*, Vol. XI, No. 5, pp. 215-227, figs. 12. Washington, D. C., May-June 1920.

The following are the anatomical differences which distinguish Arab horses from the other races: head smaller and broader; nose finer; eye larger and more prominent and alert; head articulated on to the neck at a more obtuse angle; chest broad; bones of the legs clean and very dense; etc. These differences are sufficient to mark the Arab as a separate family and the 5 lumbar vertebrae instead of the 6, common to all other horses seem to place him in a separate species. Occasionally the shortness in the back appears not in the lumbar vertebrae, but in the dorsal, 17 instead of 18; the total vertebrae number 23 instead of 24 common to all other types

Skeletons of various types have been examined at the Museum of Natural History, New York, where there is also a skeleton of a wild horse of Asia, the Prejevalsky, and also one of a Kinag (1), each with 19 dorsal and 5 lumbar vertebrae. These are considered merely individual variations, the first lumbar having developed ribs instead of the usual lateral flanges. Similar individual variation has been found in a work horse, and a Shetland pony, each with 19 dorsals and 6 lumbars. Also a Grevy Zebra which had 18 dorsals and 7 lumbars.

The short back renders the Arab horse more capable of carrying weight, and the larger abdominal capacity enables him to carry relatively more food for a long journey and he can endure privation better.

The ass, with a good weight carrying capacity has also the short back of 5 lumbar vertebrae.

The author states that the short back (*i. e.* 23 vertebrae instead of 24) is dominant only in the 1st generation of outbreeding (Arab horse × trotting stallion). In all other cases this short back is a recessive character. However, occasionally cases of atavism or reversion have been noticed, and several examples are quoted. Out breeding of the scrupulously pure Arab is therefore necessary. The Arab horse stamps his good qualities in his descendants for many generations and consequently is of distinct genetic value.

317 - **The Pony of the Island of Hokkaïdô, Japan.** — MULLER, M. (Late Extraordinary Professor of the Imperial University of Tohoka), in *Deutsche Landwirtschaftliche Tierzucht*, Year XXVI, Nos. 12-13, p 131. Hanover, November 1920.

ORIGIN. — The present ponies are not the descendants of a primitive island race. The horse, according to historical accounts, was still quite unknown to the natives only 3 centuries ago, and was imported into Hokkaïdô by the Japanese, from all the various provinces of Japan, but especially from the district of Nambon (Houshou Island). It was bred in a very primitive manner. The animals were turned out and left to themselves in pastures where there was scarcely any grass in winter, on account of the heavy snow falls.

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(1) See R. Jan. 1921, No. 79. (*Ed.*)

MODIFYING INFLUENCES. — The horses remained the property of the Government until 1860. They were intended for riding, and distributed among the post-masters (Basho). At this time, owing to a deficiency in Basho horses, the Government authorised private breeding, which resulted in great attention being paid to the animals. Later, horse-breeding was concentrated at the three pastures at Noboretsou, Niikappori, and that of the Nanac Experiment Station.

The ancestors of the present Hokkaïdô horses, and even of those of all Japan, were bred on these pastures.

They were very strong and resistant, they were also very thrifty and had solid frames. The Hokkaïdô pony differs in a remarkable manner, both in shape and performance, from the horses formerly imported from Houshow. The variations are the result of selection, change in their manner of life, and especially of the importation of relatively good stud animals of the most different breeds from old European horse-breeding centres. These animals were crossed indiscriminately either together or with the native horses, which gave rise to an extraordinary mixtur of the most different types of horse. Breeding is carried out in a primitive manner, as the Japanese have no special zootechnical methods. As a rule, half-wild so-called studs, are met with in the country, a stallion being turned out ámong 30-50 mares, no attempt being made to regulate his service. Young mares are generally used for breeding when 17-23 months old, stallions at the age of 22-23 months.

CHARACTERS. — The author has visited districts which are still but little cultivated, and where it is possible to find horses that have not yet been crossed with European blood and thus still retain the type of the horses formerly imported. The following are the results of his researches made by measuring 107 animals: — The primitive Hokkaïdô horse on account of its very small size (height at withers 130 cm), well deserves its name of pony. The head is relatively long, and usually strong, having a slight depression at the level of the frontal bones. The lower jaw is generally very prominent. The ears are, as a rule, attached very low, and heavy and thick. The eyes are small, and have a gentle expression. Temperament docile, but easily irritated. The head is generally attached low down to a relatively strong free neck, with thick curly mane and forelock The withers are little marked, being neither high nor long and are prolonged into a sharp and relatively long back. Shoulder straight. Chest narrow, thoracic circumference of the chest relatively large. Seen from the side, the hind-limb is normally developed. The fore-leg is relatively very short and the dorso-lumbar portion very long.

These horses are usually loosely built, with a somewhat sloping croup. The solidity of the bones is good for so small an animal, since in proportion to the height at the withers, the circumference of the cannon-bone is greater than that of the Arâb horse and of certain European sub-breeds. The hair, which even in summer is thick and long, attains a great length in winter, so that some of the animals resemble spaniels. The hair is usually not glossy

The Hokkaidö pony is a very primitive creature, the true product of its environment. It is generally very resistant, thrifty, and healthy but more or less ugly ; nevertheless, in spite of its small size, it is of very great economic importance If from an absolute point of view its performance is not great, it is very considerable in proportion to the size of the animal, and the care and food it receives. These horses are able to draw and carry heavy loads over very bad roads and, as saddle animals, are not wanting in endurance. The author, taking as his basis the economic conditions. of horse-breeding and the suggestions given by the Military Authorities, sets the following as the ideal to be aimed at by the breeder of the Hokkaïdö pony : — The production of a semi-large saddle horse 145-155 cm. in height with well-shaped frame, circumference of cannon-bone 20-21 cm , shoulder long and sloping, withers long and prominent, back short, haunches strong and short, hind limbs large and muscular. The horse should be very strong and docile, with much courage and agility. Its chest ought to be deep and wide.

This ideal could be attained by using stallions 160-163 cm. in height at the withers, and with cannon-bones 21.5 — 23 cm. in circumference. The best stallion to choose would be one of the hunter type.

318 - **The Breeds of Cattle in Friuli, Italy.** — BRUMER, F, in the *Deutsche Landwirthschaftliche Tierzucht*, Year XXIV, No 24, pp 249-251 Hanover, June 1920.

The author has studied the breeds of cattle found in Friuli, a region composed partly of States recently belonging to Austria (Goritz-Gradisca), and partly of territory situated within the former boundaries of the Kingdom of Italy. The results of his observations, which have been supplemened by information given by Dr. DELLA SAVIA (Udine) and Prof. SPANN (Weihenstephan), are as follows :

The breeding conditions are not favourable Owing to the predominance of the small land-owner, intensive cattle-breeding is very difficult, especially in the districts which were formerly Austrian, and where the large estates are divided among small farmers whose tenure is guaranteed by very long leases, or even sometimes by perpetual leases.

The author distinguishes 4 breeds : — 1) The old Friulan red breed (*das alte friaulanische Rotvieh*) ; 2) the new pied, red Friulan breed (*das neu friaulanische Rotvieh*) ; 3) the breed with the characters of the «*Braunvieh* " grey-brown cattle (*das graubraune Gebirgsvieh*) ; 4) the red Carinthian breed (*das karnische Rotvieh*).

(1) THE OLD RED FRIULI BREED, formerly found throughout Friuli, is now only seen in the former Austrian part, and has disappeared in the rest of the territory owing to the creation of a new Friulan race.

As regards the origin of the old breed, opinions differ very greatly. WERNER regards it as a hybrid race resulting from the cross of red Celtic cattle (rotes Keltenvieh) with steppe cattle. On the other hand, Dr. SELVAN (Udine) traces back its origin to *Bos taurus frontosus*, and to the cattle of Berne and Fribourg. WERNER's hypothesis is borne ont by the great resemblance existing between the red Friulan breed and the neighbouring varieties in Italy, and also to the pronounced steppe-cattle character (special draught-capacity) of this red race.

The colour of the coat is maize yellow and greyish red in all shades up to dark red. The pigments are black. The head is wide, particularly at the level of the forehead. The horns are long and short. The height is great in proportion to the length of the body. The legs, especially the fore-legs, are long. These cattle are excellent draught animals. In the Valley of the Isonzo, from Goritza to the sea, the cows are also harnessed. They are not good milkers, a cow giving 6 litres of milk during the height of the lactation period is considered satisfactory. Cattle-breeding in the true sense of the word, does not exist. The bulls are used for service even before they are a year old, and sometimes serve 25 cows a day. The red Friulian cattle are very resistant and thrifty, even living on the bad hay from the marshes, which is a great advantage to the farmers of the lagoons of Grado, Aquila, and other places.

(2) THE NEW PIED RED CATTLE OF FRIULI are found in the districts of Codroipo, Latisana, Palmanova, San Daniele, and Udine as well as in a large part of those of Cividale, and San Vito al Tagliamento. Finally they are also found scattered throughout the regions of Tarcento, Gemona, Pordenone, and San Pietro al Natisone.

Italian scientists consider that the Friulian pied red cattle are descended from *Bos taurus frontosus jurassicus* (SANSON's classification), which corresponds to the *Bos taurus frontosus burgundicus* of WERNER. This seems very possible, when we realise the large number of spotted animals imported during the last decades, and notice the shape of the new breed which has the pronounced character of the pied cattle. Breeders finally, after many failures, turned their attention exclusively to importing Fribourg and Simmenthal animals and met with brilliant success.

The colour of the coat is maize-yellow, and is spotted in all shades up to dark-red. The pigments and mucous membranes are pink. The tuft of the tail and the hairs of the ears are white or red. Dark spots of colour are not allowed. The colour of the horns and hoofs is waxen yellow. The bulls measure 1.50 m. at the withers and the cows 1.40 m. The height should never be below 1.35 m.

In contrast with the old race the width, length and depth of the body are proportionate to the height at the withers. The head is not too heavy and the forehead is wide. The horns are of average length, and directed sideways and forwards. The muzzle is prominent and fleshy. The eyes are large. The skin of the lower jaw is loose and in folds. The back is straight, the tail long and remarkably slender, the dew-lap hangs low and in folds.

The pied red cattle of Friuli are multiple-purpose animals, which makes them very valuable to their owners, who are mostly small farmers. These cattle reach maturity very early, and attain their maximum weight at 5

. years of age The following Table (Journal of the Udine abattoir) shows the distribution of live weight and of net flesh : —

	Bulls	Cows	Calves (of 2 ½ months)
Live weight	1130 kg	905 kg	165 kg
Net meat weight .	570 «	450 »	132 «
» o	50 %	50 %	80 %

These animals fatten very readily and the meat is much in demand, as its flavour is excellent; therefore the exportation of fat calves plays a great part in the industry. In 1910, 50 000 calves were exported from Venetia, Tuscany, Emilia, and Lombardy. The milk yield of the pied red cattle is not so good as their beef production, although they give as much as 2000-2500 litres annually, the fat content being 3.5 %.

Milk that is not used for rearing calves, is taken by the numerous dairy syndicates Although the new breed does not appear to have inherited the working capabilities of the old breed, these cattle are nevertheless good draught animals.

Throughout Friuli, the cow is chiefly used for ploughing and other field-work. The proportion of cows and bulls thus employed is as 4 : 1

By the introduction of a system of licences for bulls, breeding became a more serious business In addition to many private bull owners, there are now a large number of breeding societies that regularly import bulls from Switzerland. During the last ten years, there has been a marked inclination towards greater freedom in the importation of Swiss stud cattle, the principle adopted having been to maintain the present type by careful breeding and the use of suitable bulls. The improvement of breeding, as well as its supervision, is in the hands of Provincial Commissions appointed by the State and of the Friulan agricultural Society.

THE GREY BROWN CATTLE are chiefly seen in the Sacile district, and the neighbouring parts of Pordenone and Aviano. On account of their strong constitution and solid hoofs, these animals are very well suited to working in mountainous regions, and are therefore preferred to the Simmenthal breed. The grey-brown cattle much resemble the brown Schwyz breed, but whereas the latter are rather short and thickset, and are only dual-purpose animals, milk production being predominant, the former, on the other hand, are taller, and have a longer body, being thus suitable for every purpose, and are especially good draught cattle.

THE RED CARINTHIAN BREED (1) is common in the following districts of Upper Friuli : — Tolmezzo, Ampezzo (Carnia), Moggia, Spilimbergo, Maniago, Tarcento, Gemona, and Cividale. As regards its origin, German and Italian technical experts differ, and whereas the former, judging by the general appearance, class this breed among the group of the representatives of *Bos taurus longifrons alpinus* (*brachycerus*), the latter consider it nearly related to the Müllthal race.

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(1) *Suddeutsche Landwirtschaftliche Tierzucht*, Year X, No 17, Nov 1915 · Dr. SPANN (Weihenstephan), " Einiges uber die Viehzucht in Udine unter besonderer Berucksichtigung des karnischen Viehs ". (*Ed*)

The coat of the Carinthian cattle is of different shades of red, with a light stripe. The horns are yellowish-grey at the base, and have black tips. The height at the withers is as much as 1.20 m., the live weight of the cows varies from 250-300 kg. and the milk yield never exceeds 2000 litres.

319 – **The Efficiency of Purdue Calf Meal as a Milk Substitute in Calf Feeding.** — SPITZER, G., and CARR, R. H. (Purdue University Agricultural Experiment Station), in *Bulletin* No. 246. pp. 1-8, figs. 2, Lafayette, Indiana, 1920. and reviewed in *Experiment Station Record*, Vol 43, No 91, pp 875 876 Washington, 1921.

Purdue calf meal consists of maize meal, linseed meal and liquid beef blood (8 : 1 : 12) plus steamed ground bone to the extent of 1 %. This is dried for from 4 to 6 hours at a temperature not over 140°F, and then ground.

An hour or so before feeding it is mixed with 4 times its weight of warm water, forming a jelly. This is again diluted at feeding time and is fed at blood heat. Liquid blood meal thus prepared, was more readily digested than commercial dried blood.

A group of 36 grade Holstein calves varying in age from 10 to 20 days, and in weight from 85 to 126 lb. were fed for 140 days. A lot of 12, receiving whole milk throughout, showed an average gain of 1.91 lb. per head. A similar lot fed on skim milk, after the first 10 days showed an average daily gain of 1.73 lb. and a third lot fed on Purdue calf meal gained 1.18 lb.

Ground maize and oats (1 : 1) was fed as a dry mash to each lot, and for part of the time the calves had access to bluegrass pasture (*Poa pratensis*) or clover hay.

The calf meal lot were thrifty and remained in good condition, and during 6 months of pasture following the feeding period, they gained about the same amount as the other lots.

320 – **Experiments in Feeding Maize Cake to Milch Cows in Italy.** — BONOMI, L., in *Il Coltivatore*, Year LXVII, No 4, p 110, Casale Monferrato, February 10, 1921.

The author has studied, at the Udine Agricultural Station, the effect of adding maize cake to the ordinary ration of milch cows in different stages of gestation and lactation, and has obtained the following results:

(1) At an advanced stage of gestation (7 months), the milk yield of a cow receiving 500 gm. of cake daily, diminished (this however, may well be attributed to the fact of her being in calf). No increase in live-weight was observed.

(2) In the early stage of gestation (3 months), the weight and milk yield of the cow fed 500 gm. of maize cake a day increased.

(3) At the post-puerperal stage (1 month), the amount of milk increased progressively in proportion to the gradual increase of the quantity of cake given (from 1 to 2 kg.). The fat content of the milk was maximum when 2 kg. of maize cake was added to the ordinary ration. Hence the addition of maize cake, at a given time, improves milk production.

321 – The Feeding of Dairy Cattle with Guango Pods (*Inga Saman*) in Jamaica. — COUSINS, H H, in *The Journal of the Jamaica Agricultural Society*, Vol XXIV, Nos 6-7, p 157, Kingston, June-July 1920, and *The Tropical Agriculturist*, Vol LV, No 5, p 342 Peradeniya, Ceylon, November 1920

The Government Farm at Hope has had extensive experience of the use of Guango (*Inga Saman*) pods for feeding dairy cattle during the past 3 years, and it is due to this valuable material that 300 head of cattle were kept on a little over 200 acres of land at Hope in 1919 and 1920

Guango was fed freely to all classes of cattle including calves, and it is considered that 15 lb. per day is a reasonable allowance for a mature animal. Many cows will, however, eat 25 lb. per day without injury In 1919, 278 tons of pods were stored and during the year about 310 tons were actually fed to the cattle.

The author emphasises the fact that guango is dangerous if fed under the following conditions: 1) Mixed with silage; 2) after the pods have fermented, as the pod is a saturated solution of sugars and if they get wet they ferment and poisonous effects result from their consumption by cows, 3) in excess, which is liable to cause skin eruption and renders the animals no longer good dairy stock, 4) crushed and allowed to ferment The kernels of guango are astringent and readily fermentable, and cause irritation to the intestines and possibly subsequent death It is now considedered that unless crushed with corn cobs or megass guango and the milk product dried for some hours at 150°F it is safer not to crush the pods, but to feed them whole.

322 – Influence of the Time of Calving Upon the Annual Milk Production of Cows. — SCHMIEDER, in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, No 5, p 46, Hanover, January 1921

Experiments based upon three factors, which were, as far as possible, the same in the case of the respective herds· — 1) The dates of the beginning and end of the grazing season, 2) the annual milk yield; 3) food. The average annual milk yield was 2112 kg for herd A, and 2241 kg. for herds B, C and D.

The cows were grouped according to the date of calving Their annual milk production is given in the following Table.

		Stall fed Time of calving April May 2 *months* before being put out to grass	Beginning of grazing season Date of calving June	Middle of grazing season Date of calving July-Sept	End of grazing season Date of calving Oct Nov.	Stall-fed after grazing season	
						December to January	February to March.
Herd A Total 71 cows	Number of cows average . . .	6	16	17	9		17
	Milk yield . .	2418 kg	2051 kg	2142 kg	2280	2081 kg	2133 kg
Herds B C-D Total 82	Number of cows	14		19	18	14	
	Average of Milk	2380 kg	2075 kg	2177 kg	2241 kg	2326 kg	2264 kg

Herds B, C and D, being too small to furnish a large enough number of cows for each group, were examined together. Cows with an extremely high or very low milk yield were not taken into consideration.

As the Table shows, the best time for calving is during the 2 months before the cows are put out to grass, and what is rather surprising, the worst time is the beginning of the grazing season.

This fact the author explains from the physiological standpoint. He considers that it is because the mammary glands, which had already become less active are roused to greater activity by the change of diet.

323 - **Pea Straw for Fattening Cattle in the United States.** — HACKEDORN, H., in *The Breeder's Gazette*, Vol. LXXVII, No. 15, p. 966. Chicago, April 8, 1920.

Feeding experiments carried out at the Washington Experiment Station for 95 days with 4 uniform lots of 6 high-grade Shorthorn steers. Each lot received the same mixture of concentrated feeds: steam rolled barley + cottonseed meal, ratio 7 : 1 (in pounds).

The results are given in the appended table.

	Pea straw	Alfalfa	Pea straw + alfalfa	Pea straw + maize silage
	lb.	lb.	lb.	lb
Av. initial weight	950.5	950.7	959.1	956.8
Av. final weight	1182.3	1181.3	1195.8	1215.6
Average grain	231.8	230.6	236.7	258.2
Av. daily grain	2.44	2.43	2.49	2.22
Av. daily ration				
Grain	15.06	15.07	15.07	15.08
Pea straw	18.96	—	9.90	8.67
Alfalfa	—	14.74	7.34	—
Maize silage	—	—	—	20.88
Feed per 100 lb. grain				
Grain	617.1	620.0	604.2	555.4
Pea straw	766.6	—	397.0	319.4
Alfalfa	—	606.7	295.0	—
Maize silage	—	—	—	769.3
Cost of 100 lb. grain	$ 25.92	$ 28.68	$ 26.78	$ 24.33

The author considers as a result that the pea straw for fattening cattle is about 30 % less efficient than the alfalfa.

324 - **Tests in Winter Feeding of Lambs.** — LONSDALE, T. W. (Manager of the Moumahaki Experimental Farm), in the *New Zealand Journal of Agriculture*, Vol. XXI, No. 4, p. 203. Wellington, Oct. 20, 1920.

Report of a test experiment with white face lambs, which had not previously received artificial good. The animals were divided into 4 groups: 1) those turned out on swedes, with the main flock of lambs, which received in addition as much chaffed pea straw as the animals could consume; 2) those on pasture and given lucerne hay *ad lib*; 3) those on pasture with other sheep; 4) those on pasture and fed with ordinary hay.

The average weight per head at the commencement and end of the trial, (May 25 to July 24) together with the respective gains for each group were as follows :—

Group	Weight per head	Gain per head
	lb	lb
1	64 — 75.6	11.5
2	63.2 — 74.3	11.1
3	54.2 — 64.4	10.2
4	62.3 — 73	10.7

It is evident that while all the lambs made ordinary winter growth there was very little difference between any of the groups The author indicates that the results of this trial must not be taken as conclusive, but they point to the fact that with judicious treatment, the deathrate of young sheep during their first winter can be considerably minimised

325 - **Poultry Keeping in Fruit Plantations.** — GARRAD, G H, in *The Journal of the Ministry of Agriculture*, Vol XXVII, No 4, pp. 350-359 London, July 1920.

The author's object is to show that poultry keeping and fruit growing can be made a very profitable combination. A detailed report is made of the work carried out on 14 ½ acres of land in the south-east of England on a steep hill facing south. The author himself checked the accounts of the said fruit farm.

The results supported the opinion expressed by THEOBALD, the Agricultural Entomologist, that the employment of poultry as a means of checking some of the insect pests of fruit is a subject that deserves far more attention than it has hitherto received. As an example of what fowls eat in an orchard, he gives an analysis of the crop and gizzard contents of a White Leghorn chicken of 5 weeks old, namely 190 pear midge maggots, 127 aphides, 12 red ants, 2 tortrix caterpillars, and 1 beetle in addition to grain, seed and other foods. A Red Sussex pullet contained 14 leather jackets, 10 fever flies, 2 wireworms, 4 cutworms, 5 beetles, 50 ants, 7 woodlice, 4 slugs, 1 millipede and 20 larvae of the winter moth The light breeds, such as Leghorns, hunt the best and go further afield than the heavy breeds such as Wyandottes and Orpingtons, and in orchards of standard trees they are therefore the most suitable breeds to use for this purpose.

With reference now to the fruit farm in question, the owner does not believe in deep digging because it prevents the fine feeding roots of the trees from working their way close up to the surface of the ground where they can make full use of the poultry manure Also a shallow tilth is preferred to prevent the winter caterpillars that fall from the trees, burying themselves deeply in the soil The practice of walking through a plantation and shaking each bush is recommended, as the poultry follow and consume each caterpillar as it falls to the ground. Only young chickens are allowed to run among the gooseberry bushes, the hens being confined in coops but hens properly fed will not attack the fruit (nor even currants until they begin to colour), and do a great amount of good by picking off the scale insects. They are also invaluable in dealing with raspberry and loganberry beetle, but do not attack the hairy sawfly caterpillars on gooseberries, and only cuckoos will deal with these. Windfall apples will, of course be attacked by the birds but this is unavoidable.

No expensive poultry houses or appliances are kept and nearly all are home made. A 100-egg incubator has been used on a few occasions in the past 2 seasons, but with that exception all the eggs have been hatched out under hens The breeds kept are the White Wyandottes, Buff Orpingtons and White Leghorns; all general utility fowls.

From the balance sheet it is evident that the poultry proved exceedingly profitable. The 5 years under consideration have all been years of war, and the prices have consequently been high in all directions. It is interesting to note that on November 1, 1914, HALL the owner of this farm, possessed 152 head of poultry, of which 138 were hens and pullets, and that in 5 years, he sold:—

	£	s	d
98 761 eggs for domestic purposes at 3*s*. 2*d*. per doz. .	1 240	1	7
12 557 eggs for setting at 4*s* 6*d*. per doz.	234	14	4
657 infertile eggs at 1 1/2*d* each	4	9	0
1 811 day old chicks at 1s 4*d*. each	106	11	8
2 216 birds of various ages at 3*s*. 11*d*. each	439	9	10
Total	2 025	6	5

His stock at the end of 5 years had increased from 152 to 406 birds, and his food bill for the 5 years amounted to £ 1008, 13 2d.

For 1 year (Nov. 1918 to Oct. 31 1919) the profit (rent and labour deducted) was £419, 19s. 1d.

326 – **Comparison of Poultry Breeds.** — BORGH, O. Y., in *Minnesota Agricultural Experiment Station Report of Grand Rapids Substation*, 1915-1919, pp. 71-72.

The following table summarizes 3 years records of production. The flocks were managed as in a commercial establishment and consisted chiefly of pullets and yearlings.

Breed	Eggs per hen	Feed consumed per hen	gs per of feed	Average weight of an	t of egg hen	weight hen	Ratio body weight to weight of eggs	
		lb.		ounces	lb.	lb.		
Single Comb White Leghorn	121 91	58.50	2.35	2.15	16.38	3.90	1 : 4.20	3.12
Rhode Island Red	104.82	97 98	1.08	2.12	13 89	5.80	1 : 2.40	1.25
Barred Plymouth Rock . .	86 30	86.73	1 00	2.02	10.89	6.70	1 : 1.63	0.85
White Orpington	81.78	115.23	0.71	2.02	10.32	7.10	1 : 1.45	0.19

327 - **Experiments in Breeding Bivoltine Silkworms in Brianza, Italy.** — PODESTÀ, D., in *Il Coltivatore*, Year LXXVI, No. 35, pp. 946-948, 1 fig. Casale Monferrato, December 20, 1920.

The author obtained 1 ounce of the eggs of the " White Japanese " bivoltine breed of silkworms sent to an Italian sericulture Commercial House. When the silkworms hatched out, he divided them into 4 lots, sending 3 of them to peasants, and keeping the 4th to rear himself at Garlate (Como). Of the 3 lots entrusted to peasants, 2 were wholly or mainly destroyed by the cold, while the 3rd barely yielded 700 gm. of cocoons, and 300 gm. of "*strusa*". The lot reared by the author only produced 1500 gm. of cocoons, and 100 gm. of waste silk. The development of the silkworms was irregular, the cocoons being of very variable dimensions, but as a rule, quite small (about 1100 going to make a kg.). The spinning results were unsatisfactory, 41.20 kg. of waste silk being obtained per 100 kg. of spun silk. The silkworms began to hatch out at the end of August, and the moths emerged from the cocoons at the end of November. These somewhat discouraging results convinced the author that it is not advisable to try and rear bivoltine silk worms, where there is any risk of sudden falls of temperature in September. Better results might, however, be obtained, if the larvae were hatched from the end of July to the beginning of August. This plan would also have the advantage of making the vintage coincide with the time of the second rearing, which would be a convenience to the workers.

FARM ENGINEERING

328 - **Results given by Tractors in Belgium.** — LEPLAE, E. (Professeur à l'Université de Louvain, Rapporteur de la Commission de Motoculture du Conseil superieur de l'Agriculture, in the *Journal de la Société nationale des Agriculteurs de Belgique*, Year III, No. 7, pp. 49-53. Brussels, Feb. 12, 1921.

By command of the Conseil superieur de l'Agriculture an enquiry was made as to the results given by tractors in Belgium.

A series of questions were sent out to a great number of farmers who were known to use tractors, and by December 1, 1920, about 90 answers were sent in.

The abstract of these answers is not yet finished, and the present communication only gives the most interesting points, viz., ease of working, frequency of stops, cost of repairs, probable influence of motor-cultivation on the use and upkeep of horses and draught cattle, work other than ploughing, areas cultivated, consumption, etc.

The inquiries sent out did not refer to mechanical traction only, questions also being asked about draught animals, in order to compare costs of work and upkeep between draught animals and tractors.

The replies are not yet tabulated. The replies analysed are here presented to show as clearly as possible the conclusions drawn from them.

I. — SATISFACTION GIVEN BY THE WORK OF THE TRACTORS. — *Question.* Are you satisfied with the work of your tractor? If not, state your reasons. Will you continue to use a tractor?

The replies were remarkably unanimous. Out of 45 farmers, 42 declared themselves satisfied or very satisfied. Only one wished to part with his tractor which appeared to be in a very bad condition. Others complained of the cost of petrol, the impossibility of ploughing without ridges, and in one case where the complaint was insufficiently deep ploughing, the farmer wanted to plough to a depth of 30-35 cm.

Out of 45 farmers, 43 intended to continue using a tractor. One exception found the cost of petrol too high and the other although possessing a good make of tractor, said it had never worked properly or given good service.

II. — IMPORTANCE OF THE WORK DONE BY THE TRACTORS. — From the 67 replies received it appeared that the tractors were largely used, for areas from 50-150 hectares, the usual areas for work in silt-soil districts. Only in one case out of 45 was the tractor reported to be unsatisfactory.

III. — NATURE OF THE SOIL. — The 42 farmers who gave the nature of their soil are divided as follows :

4 farms with sandy silt loams
5 » » light » »
11 » » heavy » »
17 » » clay soils
5 » » heavy clay soils

It thus appears that tractors are most used as might be expected, in regions with heavy soils.

IV. — AREAS OF THE FIELDS. — The fear has been expressed that tractors cannot be advantageously worked on small areas. However none of the correspondents found difficulty in working such areas, as 15 farms had plots of 3 hectares and 5 had plots of from 1-1.5 hectares. It can be admitted that the tractor works under normal conditions on 1 hectare plots. The length of the furrows is the only consideration of importance as regards this, for if they are long, the tractor will lose less time at the headlands. If plots are joined they should be made as long as possible.

V. — WORK DONE BY THE TRACTOR. — Ploughing is the principal work to which tractors are put ; the depth of ploughing varies from 15 cm. for cereals to 20-25 cm. for beet. The following table enumerates the different kinds of work in which the tractors were employed and the number of farms requiring each kind of work. Then table is compiled from 45 replies.

Stubble ploughing . . .	11 farms	Harvesting.	18 farms
Weeding, disking	19	Threshing	8
Harrowing	17	Grinding.	2
Rolling	9	Pumping	1
Weeding, rolling and harrowing combined	7	Cutting	1
Sowing	2	Sawing	1
Mowing.	3	Traction	1

The use of tractors is now well understood on certain farms where the work is combined work *i. e.* weeding, rolling and harrowing, and where the tractor is used for harvesting and threshing. In order to use a tractor economically it must be given sufficient work, such as pulling a multi-furrow plough, a large disc harrow or scarifier, or a combination of a scarifier pulling a roller and a harrow, or two mowers or harvesters, etc.

The tractors, being provided with strong machines and usually developing 15-20 H. P., can all be used to pull the beet wagons in the fields or along the roads. They have been successfully used for lifting beets, by means of lifters taking 3 rows at a time.

VI. — AMOUNT OF WORK DONE IN A DAY. — The area worked in a 10-hour day depends very much on the resistance of the soil, and the nature of the work. In the 45 farms mentioned above, the area worked per 10 hour day, the results, using one tractor in each case, were as follows:

Ploughing, according to the nature of the soil, from 1-3 hectares.
Stubble ploughing, 2.5-8 hectares.
Scarifying, disking, 4-12 hectares.
Rolling, 5-10 hectares.
Harrowing, 5-20 hectares.
Rolling and weeding combined, 5-10 hectares.
Reaping, 3-7 hectares.
Mowing, 3 hectares.
Threshing, 120-200 sacks.

The big differences between the area worked per day of light work (scarifying, rolling, harrowing, reaping) is due to the fact that some farmers use the tractor to pull narrow horse implements, whereas others use wide implements that cover a much greater surface per day.

VII. — FUEL USED. PRICE OF FUEL AND OIL. — Out of 47 farmers that used a tractor, 15 used petrol and 32 paraffin. Petrol cost 2 fr. to 2.40 fr. per litre, and paraffin cost 1 fr. to 1,50 fr. per litre, generally 1.12 fr. to 1.25 fr. per litre. Lubricating oil cost from 2.25 fr. to 4.25 fr. generally 3.50 to 4.25 fr. per litre. The consumption of petrol, paraffin, and lubricating oil varies very much according to the depth of work and nature of the soil.

Ordinary silt loam. — Ploughed 20 cm. deep, 2.5 hectares per day, 30-35 litres of petrol per hectare per day.

Clay or heavy silt loam. — Ploughed 20 cm deep, 2 hectares per day, 35-40 litres of petrol per hectare per day.

Usually less petrol than paraffin is used, but the difference is not more than 5 litres per hectare, so that, taking into consideration the present prices, it is cheaper to use paraffin. Most petrol tractors can run on paraffin if the carburettor is adjusted.

The quantity of petrol used per day to start tractors that run on paraffin varies from 2-8 litres, but these figures are not of much value as the exact amounts were not ascertained very accurately; 4-5 litres per day should be enough.

The lubricating oil consumed varies from 2-10 litres per day. Such great differences should not occur and are due to inexperienced drivers. Oil is now very expensive and great care in its use should be taken. According to the statements received, the consumption should not be more than 3-5 litres per day, and in some cases may even be less.

VIII. — EASE OF CONTROL. — In 44 cases out of 45, the farmers found the tractors easy or very easy to handle. Complication in the tractor is more apparent than real and offers no obstacle to agricultural work; the same applies equally to binders.

IX. — DRIVERS AND ENGINEERS. WAGES. — In order to obtain information as to the knowledge and skill of the drivers, the farmers were asked whether they employed a farm hand or a driver mechanic to drive their tractors. Out of 45 who answered, 25 employed a farm hand as driver, 4 employed a labourer who had been through a course of mechanics or had worked in an agricultural engineering works, 7 had engaged a driver-mechanic, 5 employed their sons, and 1 drove the tractor himself.

The farm-hands received 15-20 fr. a day, or 12 fr. plus food and lodging. Some farmers paid a fixed wage of 10-15 fr., plus a bonus of 2 fr. per hectare ploughed, 0.50 fr. per hectare weeded, harrowed, or rolled. Some paid 7-10 fr. plus food. Some gave the same wage as the labourer plus emoluments, such as clothes or supplements. The work is looked upon as less tiring than driving horses.

The labourers who had been through a course of mechanics were paid the same wages as the others; the replies unfortunately, apparently show no difference as regards this. The driver-mechanics received 225 to 450 fr. per month, plus food, lodging and heating. This corresponds to 9.37 to 18.74 fr. per day per month of 24 working days.

X. — FREQUENCY OF STOPS AND ACCIDENTS. COST OF REPAIRS. — Although there were not many replies and although the tractors in question had not been in use for more than 6-12 months, it clearly appears that the wear depends chiefly on the area worked. On a farm of 200-400 hectares, a tractor ploughs many hectares per annum, wears out more rapidly, and costs more in repairs and maintenance than when working an average 50-100 hectare farm.

The skill of the driver has a great deal to do with the number of accidents. The author has here grouped the information obtained according to the different classes of persons employed as drivers.

Ordinary labourers. — Tractors of all makes driven by ordinary farm labourers and in use only for from 2-6 months (1920) required, as a rule, no more than the usual slight repairs, due to wear and tear. But with tractors employed for about 12 months (autumn 1919, spring and summer, 1920) on farms of 100 hectares there was an average of 2-10 accidents (parts broken, strained or worn), costing altogether 250-700 fr.

Some tractors of the same make working 300-400 hectare farms cost as much as 1600 fr. for repairs during their first year.

Labourers who had received instruction. — Accidents were not numerous, save in one case when the tractor was laid up 10 times, costing 1200 fr. for repairs and losing $^{1}/_{10}$ of the usual time (the farm covered 400 hectares).

Farmers' sons. — Accidents were as frequent as with farm-hands. During 20 months, and with farms of 80-100 hectares the cost of repairs was 700-1000 fr.

Driver-mechanics. — No tractor had been working in their hands for more than 6 months and there was no need for repairs.

XI. — ADVANTAGES OF THE USE OF TRACTORS. — The replies showed that there were many advantages, which can be classified as follows:—

Manual-labour. — There is a great economy in manual labour. The tractor will work 2 hectares per day, whereas a 3-horse team on the same land will work 40 acres, so that 5 teams are required to do the work of one tractor. The tractor required one man, and therefore replaced 5 three-horse teams or 5 men and 15 horses. The tractor also tends to obviate the need of keeping extra hands in readiness for the busy seasons. Again other correspondents stated that with the same number of men they could work a much larger area.

Teams. — Most of the correspondents stated that the tractor replaced a certain number of horses or oxen; some have given up horses, but most have eliminated draught cattle.

The estimates of the number of horses replaced were very varied, some estimating that the tractor replaced 4-6 horses per 110-hectare farm, others that it replaced 6-9 horses on a similar farm. This gives a saving of about 60-90 fr. a day for food.

The number of oxen replaced by a tractor was from 9-12. One gave up all his oxen on a 165-hectare farm; another eliminated 10 oxen on 84 hectares, and a third all his oxen on a 315-hectare farm.

The tractor lightens the work of the horses, gives rest to the brood-mares, and facilitates the work at times of harvest and ploughing. Again they save the extra ration needed by the horses at these times, which amounts to a great deal in a large stable. A supplement of 3 kg. of oats per horse for 3 months of the year represents for 18 horses a cost of 5000 fr.

Quality of the work. — Most of the replies claimed as advantages the rapidity of the work, the possibility of stubble ploughing immediately after the harvest, and the possibility of ploughing and preparation of the land at the right time. Especially is this useful when the weather is bad, as, in a few fine days, a tractor, can prepare the land very quickly, especially if wide implements are used, as many farmers do.

The correspondents were very satisfied with the quality of the work, and 38 out of 46 stated that the ploughing was as good or better than that done with horses, and that the greater speed of the tractor pulverised the earth better. Eight replied that horses did the work better, because it is more difficult to regulate a 3-furrow plough, whilst the mould-boards were not quite suited to the silt-loam regions of Belgium. Seven farmers stated that the manure was not buried as well, but that this was the fault of the plough, and not of the tractor. When using a tractor for harvesting, 18 farmers stated that the work was done perfectly, and one correspondent stated that this was because of the regularity of speed of the tractor. Only on ereply was unfavourable, the fear being the wear would be too great owing to the speed of the tractor.

The 20 correspondents who had not yet used the tractor for harvesting stated that they were going to do so, and had no doubt that the work would be very well done.

XII. — DISADVANTAGES AND DIFFICULTIES IN THE USE OF THE TRACTOR. — In reply to this there were 45 very interesting replies, 19 stating that there were no disadvantages and no difficulties. The others pointed out the following disadvantages:—

Cost of the tractor too high (2 replies).
Price of spares excessive (1 reply).
Cost of petrol, paraffin and oil too high (8 replies).
Difficult to find good driver-mechanics (6 replies).
Mechanism too complicated (1 reply).

Consumption of fuel too high (1 reply).
Wear of tractor too rapid (1 reply).
Forced to plough without ridges (3 replies).
Tractor goes badly in damp weather (1 reply).
Tractor does not bury strawey manure well (1 reply).
Weight of tractor is not enough for carting on the roads.
The tractor suffers when run over paved roads.

XIII. — WEAR AND TEAR. — The tractors in Belgium have not been at work long enough to judge their resistance to wear and tear. This question was asked in the following terms:— For how many years do you think that your tractor will work without needing serious repair?

Out of 43 replies, 16 had formed no opinion, 4 hoped that the tractor would last from 6-10 or 15 years, 9 counted on 4-5 years, 12 judged 3-4, and 2 only counted on 2-3 years' service. The average estimate was therefore well over 4 years.

It is concluded that, with tractors which have worked for more than a year, or over a large area, economy in work largely depends on the resistance to wear of the tractors, and the farmer should therefore buy, machines that are carefully and strongly built.

329 - **The Sinking and Adherence of Agricultural Tractor and Motocultivator Wheels.** — LOMBARDI, M., in the *Reale Istituto Lombardo di Scienze e Lettere, Rendiconti*, Series II, Vol. LIII, Parts 10-11, pp. 415-434. + 6 figs. Milan, 1920.

The author studies the nature, relation and dependence of the different factors which oppose the progress of the wheels of agricultural machines, and he examines mathematically the sinking of the wheels, the influence of the irregularities of the soil, other resistances of the soil, the action of grips, passive work due to the grips and the effect of grips on adherence. He demonstrates how these resistances can be theoretically studied and determined by simple analytical expressions and methods, the comparative importance of the different passive resistances — the necessity, especially as regards strakes for gripping, of judging the capacity and usefulness of a plough in relation to the conditions to which it is suited, and to guard against the error of thinking that it will give satisfactory results under any conditions. Finally the author insists on the urgent need for establishing the laws of variation and the values of the coefficients of inelastic and elastic compression of adhesion, of rescission, and of soil friction, especially with regard to an ordinary wheel that is moving under load.

Only then can accurate practical formulae be evolved which will enable the maker to design and the agriculturist to choose the machine that is most suited to particular types of work as regards the wheels and gripping pieces applied to them.

330 - **Safety Pendulum for Tractors.** — DESSAISAIX, R., in the *Journal d'Agriculture pratique*, Year LXXXIV, No. 40, pp. 397-398 + 1 fig. Paris, Nov. 11, 1920.

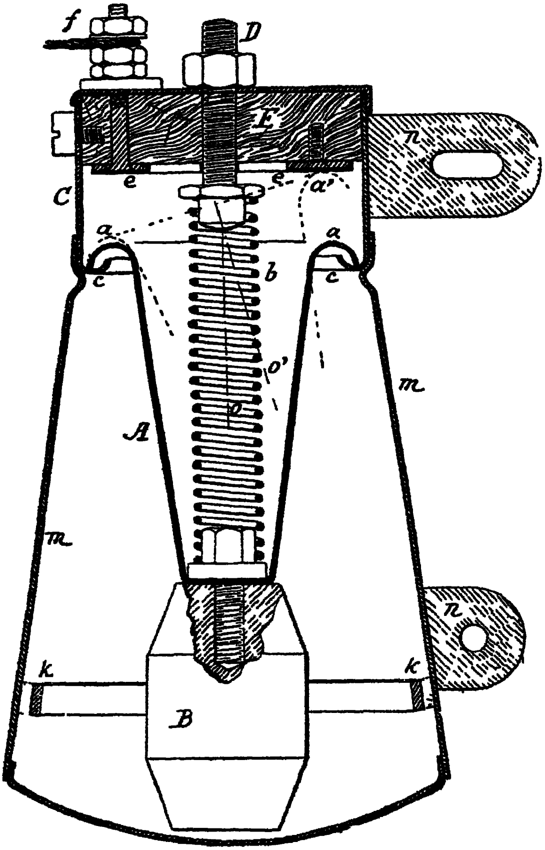
When a tractor is required to furnish a pull that rises momentarily above a certain limit, one of three things happens:—

(*A*) The motor is not powerful enough:

1) The maximum effort has the effect of braking and "blocking" the engine, which stops suddenly, and usually damages the drive of the fan when operated through gears.

(*B*) When the motor is very powerful, 2 things may happen:

2) When the soil is relatively open or damp, the driving wheels slip and the grips dig up the ground, burying the wheels until the frame or other part stops the machine from sinking further



Safety pendulum tor tractors.

3) If the soil is resistant, the driving wheels are gripped and stop turning, and the tractor tends to rear up.

In each case it is necessary to unhook the tractor before the engine is restarted.

The third case is dangerous if the driver has not the sense to throw the machine out of gear or stop the engine before the tractor tips up. Machines with powerful engines and a light forecarriage are specially liable to tip up and injure the driver. In order to prevent accidents like this M. E. FEUILLETTE, a farmer of Perthuis (Saint-Maurice-sur-Aveyron, Loiret), has invented a safety pendulum which automatically cuts off the ignition when the tractor tips up to a dangerous angle.

The principle of this pendulum is shown in the diagram.

A pendulum *B* is solid with an inverted cone *A* with its upper edge *a* flanged, and resting on a collar *c* of the cap *C*, a spring *b* bolted to the cap at *D* steadies the pendulum against vibration. The upper part of *C* is closed by a cover *E* which bears an insulated ring *e* which is connected through the terminal *f* to the coil of the magneto. When the tractor tips, the pendulum swings out of the normal axis *o* to *o'* and the lip *aa* of the cone rises to *aa'*, thus making contact with the ring *e*, so that the ignition is at once suppressed automatically, thus stopping the engine.

The part *ef* can be replaced by an insulated ring *k* connected to the magneto, — contact being obtained through a point on the side of the pendulum *B*. The instrument is encased in *m* which is fixed by means of *n* to a suitable place on the frame. The same principle can be used, by means of levers and cranks, as an automatic control of the gas inlet, so that when ascending a rise, more power is given, and when descending, the gas is shut off in proportion to the steepness of the slope.

331 - **Utilisation of Automobile Engines.** — RINGELMANN, M, in the *Journal d'Agriculture pratique*, Year LXXXV Vol. 1, pp. 12-16, + 5 figs. Paris, Jan. 6, 1921.

The utilisation of old touring-car engines may be of interest to country agricultural work-shops, repair-shops, and for grinding and crushing grain, in cider factories, for pumping water, etc.

It is preferable to remove the engine from the chassis and bed it on a suitable frame resembling that used as a bed for testing engines in a motor works. The frame may be made of double *T* irons, or of hard wood, and the engine bed bolted on to it. For certain kinds of work it is best to gear the engine down. This can be done by keying a pinion on to the main shaft geared to a counter shaft such as is used in electric dynamo plants. It is better to have spur gearing which is silent or a green leather pinion. The countershaft, running at, say, 250-300 revs. per min., carries a belt pulley.

The fan-cooled radiator should be replaced by a tank placed laterally and high up. But if the water is circulated by a pump, this system should be retained as the hot water discharge pipe is not wide enough to allow a rapid enough flow of cool water if the thermosiphon is to be used

The exhaust expansion box should be done away with as it always causes a certain amount of back pressure, and a wide pipe should be substituted, that is sufficiently long to prevent flames issuing that might cause fire. By doing this the author increased the power of an old engine by 10 % at the Station d'Essais de Machines, without increasing the fuel consumption. The engine may be set on top of a brick platform about 45 cm.

high, so that it is easy to turn the starting handle, or it can be mounted on a platform provided with 4 cast iron rollers, or on a trolley. Light, high speed engines, weighing not more than 20 kg. per H. P. can only be kept steady by weighting the frame with stones, wooden boxes filled with earth, etc.

When the capacity of the engine is known, it is advisable to set up a power plant on one frame, *i. e.* pump, saw, generator, etc. It is better to use a carburettor which can use paraffin instead of petrol, or better still, a poor gas generator, to reduce the cost of fuel, especially under present conditions.

332 - **Harvest Machine for Camphor.** — See No. 294 of this *Review.*

RURAL ECONOMICS

333 - **Cost of Threshing in France.** — RINGELMANN, M., in *Journal d'Agriculture Pratique*, Year LXXXIV, Vol. II, No. 46, pp. 389-391. Paris, Nov. 11, 1920.

The author estimates the cost of threshing per hour of a set comprising 2 men (mechanic and feeder) provided by the contractor with the machine, fuel and lubricants, the price being relative to a full day's work, the cost of transport from place to place being accounted for separately, whilst the transport of coal and water and supplementary manual labour are charged to the farmer.

The author takes the material at pre-war price, the locomotive, at 5 500 fr. and the thresher at 3 000 fr. at the most, costing in all 8 500 fr. The annual expenses for amortisation, upkeep, and repairs, taken at 20 % of the first cost, is 1 700 fr. This sum is distributed over 500 working hours, i. e. 3.40 fr. per hour. A 6 H. P. locomotive consumes 2.2 to 2.5 kg. of good quality coal per H. P. per hour, or a maximum of 3 kg. Before the war, lubricants cost 0.60 fr. per kg., labourers 0.80 fr. per hour, plus 6 % for insurance against accidents totalling 0.85 fr. per hour.

The author bases his calculations on the use of old machines, as the are very few 1920 models in use (these cost 15 000 fr. for the locomotive, 5 000 fr. for the thresher, in all 20 000 fr. representing an annual cost of 4 000 fr., and 8 fr. per working hour). The fixed expenses of old machines remain at 3.40 fr. per hour ; it is possible that the cost of insurance against fire has risen, but the author has no details. With the present bad coal the consumption is 3.5 kg. per H. P. per hour. If the machine uses more it is in bad condition. The cost of both labour and fuel has risen.

According to the decree of July 31, 1920, the Ministry of Public works fixed the prices of coal as follows: medium quality coal used for threshing, etc., 275 fr. per metric ton at the pit head; English coal 300 fr. per ton on rail at port of importation. With the cost of transport and inevitabl losses on the journey the price at the nearest railway station will be 350 fr. per ton.

Lubricants now cost 5 fr. per kg.

The cost of manual labour is taken at 3 fr. per hour plus 6 % insurance, totalling 3.18 fr. per hour

The following table gives the relative cost per hour before the war and now.

	Before the war	In 1920
	Fr.	Fr.
Fixed Costs: —		
Amortisation, upkeep, repairs	3 40	3.40
Insurance against fire	(Not known)	(Not known)
Supplies:		
Coal	0.54	7.35
Oil, Cottonwaste	0.60	5.00
Increase 10 %	0.11	1.23
Labour: —		
2 men	1.70	6.36
bonus	0.42	1.59
Total . . .	**6.77**	**24 93**
Contractor's profit, 10 %	0 68	2.50
Total . .	**7.45**	**27.43**

M. A. VEZIN, directeur des Services agricoles de Loir-et-Cher, using the following data:— A high consumption of 30 kg. of coal per hour for a 6 H. P. locomotive, a cost of 310 fr. per ton of briquettes at docks, and 350-360 fr. railhead price, 2 men (mechanic and feeder), concludes that for the contractor to earn his living without robbing the farmer, there should be a contractor's charge of 12.50-16 fr. per hour, exclusive of the cost of coal, according to the wear and tear, and time lost in moving away. Coal costs 10.50-10.80 fr. per hour, hence when furnished by the contractor, he may charge from 23-28 fr. per hour.

A 6 H. P thresher requires an average of 600 kilogrammetres per kg. of sheaves yielding 0.33 kg. of grain; assuming that a working hour consists of 50 minutes, the machine can thresh 2 250 kg. of sheaves, yielding 750 kg. of grain per hour.

Given a contractor's price of 25 fr. per hour, the grain costs 3 33 fr. per 100 kg., to which the amount of cost of the labour and teams supplied by the farmer must be added.

According to M. F. LESOURD, threshing wheat in Saône-et-Loire cost before the war from 1.25 fr. to 1.50 fr. per sack of 120 kg. (or 1.04 to 1.25 fr. per 100 kg.) and in 1919 it cost 4.50 to 5.50 fr. per sack (or 3.75 to 4.85 fr. per 100 kg.).

It is desirable to establish co-operative threshing societies, which could buy the machines with advances from the Crédit agricole obtained through la Caisse regional de Crédit mutuel agricole of the district to which they belong.

334 - Cost of Producing Apples in Five Counties in Western New York, 1910-15. — MILLER, G. H., in the *United States Department of Agriculture, Bulletin* No. 851, pp. 1-47, Tables XXV, Figs. 15. Washington, D. C., July 30, 1920.

A record of the relation the orchard bears to additional enterprises such as the cultivation of other fruits and beans, potatoes and hay, with details of the orchard practices followed by the more successful growers, the effect of these practices on yields, the returns derived from different systems of orchard management, and the cost of maintaining orchards under each system. Detailed information is given as to the time required to perform each operation, the necessary equipment, the size of the orchard, the age of the trees, the yield of fruit and other related factors. This investigation was made on 218 apple bearing orchards in the most intensive apple producing area in Western New York, including the counties of Monroe, Niagara, Ontario, Orleans and Wayne. The size of the orchards averaged 35 trees per acre, and the average age was 40 years. The Baldwin variety constituted from 50 to 60 % of the apples grown, and Rhode Island Greening ranks second.

The average investment per acre for the orchards here considered was about $500. This investment was highest in Orleans County and lowest in Ontario. The total equipment investment per farm was $1.158,64 of which about $240 represented the spray outfit. Apart from the latter, the equipment cost $7.75 per acre.

The following list gives the average time required and the cost for the different operations with a crew of one man and two horses: —

Implement	Acres in 10 hours	Cost per acre
Walking plough	1.98	$ 3.00
Roller	12.07	0.45
Disk	7.03	0.84
Spring tooth harrow	9.67	0.57
Spike tooth harrow	11.53	0.48

The most economical means of applying manure was with the spreader. A crew of 1 man and 2 horses with a spreader, applying 9 tons of farmyard manure per acre, covered nearly 2 acres in 20 hours.

The total maintenance cost for the 218 farms was $24.75 per acre or 29 cents per barrel. Deducting a credit for the use of the orchard as pasture, there is left a net cost of $24.04 per acre, about 20 % total net cost of production. The total handling cost was $26.52 per acre or 32 cents per barrel, *i. e.* 10 % total net cost of production.

The following table gives a summary of all costs (218 records, western New York, 1910-15 inclusive).

Item	Five Counties 84.1 barrels Cost		Item	Five Counties 84.1 barrels Cost	
	Per acre	Per barrel		Per acre	Per barrel
Manuring	$ 2.05	$ 0.0244	Picking	$ 12.05	$ 0.1433
Fertilising	0.16	.0019	Shaking, picking up and hauling . . .	0.92	.0109
Pruning	4.85	.0577	Sorting and packing	6.34	.0754
Brush	2.14	.0254	Picking up and haul Culls	1.94	.0231
Ploughing	2.40	.0285	Total net handling cost minus cull credit	12.06	.1434
Other cultivating .	4.26	.0506	Total material cost .	49.07	.5835
Thinning	0.89	.0106	Total fixed cost . .	33.61	.3996
Propping	0.67	.0080	Total material and fixed costs	82.68	.9831
Miscellaneous . . .	0.08	.0009	Total net cost . . .	118.78	1.4124
Sowing cover crop .	0.09	.0011			
Harrowing » .	0.26	.0031			
Mowing	0.10	.0012			
Dormant Spray . .	1.99	.0237			
Summer	4.81	.0572			
Pasture credit . . .	.71	.0084			
Total net maintenance labour cost	24.04	.2859			

The average net cost of production was $7.41 per barrel. By deducting the same, the average net profit was 79 cents per barrel, with an average yield of 84 barrels per acre, or a net profit of $66.36 per acre. If interest on investment ($25.72) is considered as profit rather than as expense, there is a net profit of $92.08 per acre or 18 % on an investment of $514.

The product in this case is the marketable barrelled apple. The byeproducts are the apples sold to the dryer, cannery or cider mill.

PLANT DISEASES

GENERAL INFORMATION

335 - **The Phytopathological Services of Uruguay and the International Phytopathological Convention of Rome.** — Communicated by Dr. E. J. ROVIRA, Delegate of Uruguay.

I have the honour of communicating to my esteemed Colleagues of the Permanent Committee, the information that, by the instrumentality of the Ministry of Foreign Affairs, I have received from the Ministry of Commerce of my country. This communication not only shows the interest taken in the Phytopathological Services by the Government Authorities of Uruguay, but also manifests their entire approval of the work accomplished, and the conclusions reached, by the International Phytopathological Conference held in Rome.

The present constitution of the organisation of the Uruguayan Phytopathological Services completely complies with the formalities declared obligatory by the Convention of Rome in the case of all the contracting States. Through the initiative of Uruguay, an International Phytopathological Conference, similar to that held in Rome, met in Montevideo in May, 1913. It approved three Conventions which, taken together, indicate and establish the same measures as those enforced by the Convention of Rome, and lay similar obligations upon the adherent States.

For this reason, the Ministry of Commerce is of opinion, that there is nothing to hinder Uruguay from notifying her adherence to the Rome Convention.

In accordance with Art. 9, of the International Convention of the « Defensa Agricola » signed at Montevideo, an International Bureau, with headquarters at that town, has been established under the direction of an agricultural expert appointed by the Government of Uruguay. We may therefore conclude that this Bureau will be of great use in establshing international relations with a view to diffusing information respecting the movements of agricultural pests, and the means of their control.

The fact of its existence shows that since the headquarters of this movement in established in S. America, Uruguay should recognise its own obligations and those of the other States united together by the bond of a common aim.

In agreement with this view, and in consequence of the conclusions arrived at by the International Phytopathological Conference of Rome, the

Ministry of Commerce passed the following resolution on September 3, 1914:—

1) All plants, or parts of plants, intended for cultivation, as well as flower-bulbs and cut flowers sent abroad, shall not leave the Country unless they are provided with a certificate stating them to be free from the plant parasites enumerated in the official list of the importing State

2) The General Direction of the "Defensa Agricola" is required to take all the necessary measures for supplying these certificates and obtaining the exporters' declarations in accordance with the stipulations of the International Phytopathological Conference of Rome

3) The products mentioned in Art. 1 shall only be exported from ports authorised by the general regulations dealing with the protection of agriculture.

I much regret that this information did not arrive in time to be incorporated in the interesting report on this subject presented to the last General Assembly by the Hon Delegate of Sweden, but I hope that it will nevertheless be received with satisfaction by the Permanent Committee.

As regards the definitive adherence of Uruguay to the Convention of Rome, I am awaiting the instruction, of my Government.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

336 – **The "Cignarellone" Wheat of Molise, Italy, Resistant to Rust, Lodging and Grain Shedding.** — See No 283 of this *Review*

337 – **"Mogarbia" Wheat of Cyrenaica, Resistant to Lodging and Immune to Smut.** — See No 252 of this *Review*

338 – **Resistance of Different Varieties of Cabbage to *Fusarium conglutinans* Wollenw. in the United States.** — JONES, L R, WALKER, J C, and TISDALE, W B, in *Agricultural Experiment Station of the University of Wisconsin Research Bulletin*, No 48, pp 3-34, tables 5 + figs 10 Madison, November, 1920

The general facts regarding the nature of Cabbage Yellows (*Fusarium conglutinans* Wollenw), and the results obtained with various control measures and with different varieties of cabbage resistant to disease in 1915, have already been described (1). Since then, work has been continued with new and advantageous results here notified by the authors, with special reference to the resistant Wisconsin Hollander strain selected from the commercial Hollander or Danish Ball Head, used for winter storage purposes (1) from which further selection was made and a new resistant strain secured which combines earlier maturity with a rounded head and shorter stem, and distributed under the name of Early Wisconsin Hollander.

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(1) See *R*, March, 1916, No 355 and *R*, May, 1918, No. 594 (*Ed*)

In order to meet the needs of the Kraut industry, resistant strains have been selected from two of the leading commercial Kraut varieties, Brunswick and All Seasons. The so-called Wisconsin Brunswick XI-7-1 strain so obtained, proved the best of those tested in 1918 and 1919 but although the needs of Wisconsin growers in certain districts seemed fairly well met by the Wisconsin Hollanders and Wisconsin Brunswick, these 2 varieties did not adequately meet the national situation The resistant strains, however, obtained by selection from the All Seasons hybrid strain showed only 2 % of *Fusarium* infection, and the selfed strains scarcely more. This was a distinctly better showing than was made in the parallel trials the same season with the 2 above mentioned selections.

The following selections of other resistant varieties are recommended for further propagation and selection. Maryland Flat Dutch, All Head Early, Glory of Enkhuizen, Copenhagen Market and Late Flat Dutch. Attention is drawn to the fact that *Fusarium conglutinans* is often confused by growers with the bacterial black rot (*Bacterium campestre*), and that the selected strains mentioned have not proved to be especially resistant to this nor to the other common cabbage diseases such as *Phoma brassicae* and club root (*Plasmodiophora brassicae*) In all cases the degree of resistance to *Fusarium* shown by these strains is relative, not absolute. The seedlings are less resistant than the plants after transplanting. In consideration of the fact that high soil temperature favours the disease and low temperature inhibits it, the best results are obtained under Wisconsin climatic conditions by starting even the resistant strains in a non-infested seed bed to avoid possible seedling infection These strains are then sufficiently resistant after transplanting to give a commercially successful crop even on badly diseased soil. In order that the present standards may be effectually maintained, seed must be employed secured from plants carefully selected for resistance and type from recognised infested fields. The authors consider that through further selection, resistant strains suited to any localised conditions could be secured.

339 – **Behaviour of the "Teroldigo" and "Negrara" Vine varieties of Trentino, Italy, as Regards Diseases and Pests.** — See No 302 of this *Review*

340 – **The Part Played By Copper in Anticryptogamic Mixtures.** — VILLEDIEU, VIALA SAGNIER, H and GERVAIS, P, in the *Comptes rendus des Seances de l'Académie d'Agriculture de France*, Vol. VI, No. 31 (October 27, 1920), pp 762-766 and 754-756. Paris, 1920.

It occurred to M. and Mme. G VILLEDIEU that it would be interesting to determine whether copper is really an essential ingredient of anticryptogamic mixtures, or in other words, whether metallic copper is the substance which destroys the zoospores of the "mildew" of the vine. They were of opinion, that it was necessary to test this supposed toxic action, as GALIPPE and his successors have shown that metallic copper and most cupric compounds, with the exception of certain very acid salts such as the sulphate or chloride of copper, are innocuous to nearly all forms of life other than cryptogams.

M. and Mme. VILLEDIEU first proved the truth of the theory of the dissolution of cupric mixtures by rain-water. They had already demonstrated, by previous experiments, the fallacy of the statement that milk of lime acting upon a solution of copper sulphate gives rise to the formation of copper hydrate, which is transformed in the air into basic copper carbonate (hydrocarbonate) (1).

Subsequent experiments made with rain-water containing ammonia or carbon dioxide, or both substances in varying proportions, as well as experiments on basic sulphate or basic carbonate of copper, both pure and mixed with lime, sodium carbonate, calcium carbonate, or calcium sulphate have led to the conclusion that:—

1) With normal rainwater, it is impossible to dissolve traces of copper equal to 1 millionth part.

2) It is necessary to increase a hundredfold each of the gases present in rainwater, in order to obtain solutions containing a millionth part of copper.

The idea, hitherto accepted without any proof, that cupric deposits are dissolved by rain-water, seemed so unlikely to M. and Mme. VILLEDIEU that they investigated the cause of the effect produced by anticryptogamic mixtures. They turned to account in the laboratory the experimental results of J. PERRAUD, who replaced sulphate of copper by the sulphate of nickel or cadmium with equal success, in mixtures used for the control of vine "mildew." They studied the effect of copper and its compounds upon moulds in general, and succeeded in growing these fungi in media containing 2, 5, and even 10 % of ammoniacal citrate of copper; *Penicillium glaucum* will even live on a saturated solution of this salt.

It may be concluded from the results of these experiments, that the contact of a strong mineral acid, such as sulphuric acid, or of a mineral base or oxide, prevents the development of the fungus spores by altering the chemical composition of the contents of the initial cell, which has little power of self-defence. It also seems possible, in the case of vine mildew and other fungi, to attribute the action of the copper sulphate to the free sulphuric acid it liberates in solution, and to regard the effect of the hydrocarbonate as due to its basic nature.

In the same way, we may explain the more powerful effect of really alkaline mixture, where the alkalinity of the lime is added to that of the cupric base.

Finally, M. and Mme. VILLEDIEU confirmed their results by another experiment made directly upon the Peronospora, *Phytophthora infestans*. They introduced into culture tubes with solid media pieces of healthy potato (their freedom from disease being shown by control pieces) that had been soaked for a period varying from 6 hours to 4 days in 1 per 1000, 1 per 10.000, and 1 per 100.000 solutions of ammoniacal copper. These slices of potato, while dripping with the cupric solution, were sown with zoosporangia of *Phytophthora* taken from similar solution. After 4 or 5 days, all of them produced the conidiophores (zoosporangiophores) and zoosporangia characteristic of potato " mildew."

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(1) See *C. R. des Séances de l'Académie des Sciences*, Vol. CLXXI, p. 360. Meeting of Aug. 9, 1920.

As regards, vine " mildew," M. and Mme. VILLEDIEU, in 1920, introduced into vine stocks a sufficient amount of ammoniacal citrate of copper to allow of the presence of the copper being detected in the sap and leaves of the plants thus treated. These leaves were, however, attacked by " mildew." According to these investigators, copper is thus no more toxic to the fructifications of *Peronosporaceae* than to other fungi. It would hence appear possible *a priori* to replace it in anticryptogamic mixtures by another and more common metal.

The results announced by M. and Mme. VILLEDIEU led MM. VIALA, H. SAGNIER, and P. GERVAIS to make the following remarks: —

M. VIALA considers that the conclusion arrived at by M. and Mme. VILLEDIEU is not exact from the practical standpoint. It again leaves the question undecided whether it is really the copper that affects the " mildew " of the vine, or whether it is the acid or base present in the mixture. If however, the laboratory experiments of these two workers were confirmed, it would greatly reduce the expense of the control of vine mildew.

M. H. SAGNIER suggests that as these researches have only taken the form of laboratory experiments, it would be advisable to counsel vinegrowers to continue the treatment which has hitherto proved efficacious, and to wait until the new theory has been tested practically.

M. P. GERVAIS commends M. SAGNIER's prudent advice to vinegrowers, and remarks that when it has been proved by numerous experiments that copper has no effect upon mildew, some other method of treatment can be adopted, especially if it be more economical, but that the question is at present in the laboratory experiment stage. As long as it has not passed into practice, the only wise course is to continue to use the means of protection that have been recognised for a great number of years as being effective.

341 - **Diseases of Wheat in Parana, Brazil.** — See No. 285 of this *Review*.

342 - ***Septogloeum Arachidis*, Leaf Spot of the Peanut in South Africa.** — VAN DER BIJL, P. A., in *Union of South Africa, Journal of the Department of Agriculture*, Vol I, No. 6, pp. 528-530, figs. 2. Pretoria, Sept. 1920.

In South Africa and especially along the coastal region of Natal, the peanut is seriously attacked by *Septogloeum Arachidis* Rac. The disease shows itself as black, circular to irregular spots or flecks on leaves and stems; the attacked leaves die early and shrivel up or fall.

This leaf spot has also been notified in Transvaal, British East Africa and in countries other than Africa

Since the damage caused at times by the fungus is considerable, it is recommended that the material from diseased fields be burnt or else deeply ploughed into the ground.

Crop rotation should be resorted to in old lands. In regions where the trouble is known to occur a fungicide sprayed early before there are signs of disease is advised. If this spray will not benefit plants already badly diseased, it is however, even in these cases a distinct advantage as it will kill the spores of the fungus through which the disease is disseminated.

343 - **Anaerobic Bacteria and Gummosis of the Walnut in France.** — DUFRENOY, J., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 3, pp. 132-133. Paris, 1921.

Of recent years, a disease has attacked walnut trees of all ages in the central Massif and in the Pyrenees ; patches of dead trees are seen surrounded by dying ones, and the malady is extending to the walnut plantations. At Nuces (Aveyron), where the walnut has been grown commercially from very ancient times, the disease shows itself on the trees at the edge of the patches, by a withering of the top branches; cracks appear in the trunks, the bark becomes dry at the junction of trunk and root, and root-rot sets in. The first sign of root-rot is a black discoloration of the extremities from which the cortex is easily detached. Mycelial filaments penetrate into the portions of the roots that are not discoloured filling the cells of the medullary rays with brown or greyish swollen bodies (arthrospores or conidia ?).

Sections of the collar or of the roots reveal (disseminated through the cambium, the wood, and especially the pericycle) numerous cells massed on the brown edges of the root cankers, and filled with yellowishbrown gum. Owing to the destruction of the pectic substance of the middle lamella, the cells become separated at the corners, and the membrane turns brown. Fragments of roots affected with gummosis, but not discoloured, after being sterilised and split were placed on peptonised gelatin containing glucose, or enclosed in it. No change occurred in the parts exposed to the air, but from those that were protected from its action, there extended through the gelatin, right down to the bottom of the tubes, grey colonies of short-rod shaped bacteria enclosed in a mucilaginous zoogloea, but which became mobile in water.

It is impossible to be certain whether these anaerobic bacteria are responsible for the death of the walnut-trees, or if, as COMES and SAVASTANO maintained in the case of the bacteria found by them, they are merely secondary parasites that have penetrated into the trees through lesions due to bad weather (cankers caused by frost cracks).

344 - **Diseases and Pest of the Vines in the State of Rio Grande do Sul, Brazil.** — Se No. 301 of this *Review*.

345 - ***Phomopsis Pseudotsugae*** **Deuteromycete Injurious to** ***Pseudotsugae Douglasii*, in England** — ALCOCK, N. L., in *The Gardener's Chronicle*, Vol. LXIX, No 1778, p. 45, figs 1. Jan. 22, 1921

During the summer and autumn of 1920, plantations of Douglas Fir (*Pseudotsuga Douglasii*) were attacked by *Phomopsis Pseudotsugae* (1) in several English localities; the characteristics associated with the attack were similar to those previously observed in Scotland.

The disease in causing serious loss among the English plantations. In one case in Hampshire in 1919, over 20 % of the young leaders are reported to have been killed, which will seriously affect the future shapeliness and value of the trees. In an adjoining plantation with trees of about 8 years old, considerable numbers of stems and branches are affected.

At Bagshot (Surrey) in the nursery at Ripley, the disease has attacked and injured a considerable number of transplants, *i. e.* 4 year old plants. At Swinley (Berkshire) and in other nurseries, the disease has attacked the leader or the young branches of a considerable number of plants. It has been found at Midhurst (Sussex), and is probably widespread, and is evidently a serious pest as regards young plantations of *P Douglasii.*

346 - ***Botrytis Douglasii*, Hyphomycete Injurious to *Pseudotsuga Douglasii*, Newly Recorded in Scotland.** — WILSON, M., in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXXIV, Pt. 2, p. 223. Edinburgh, Nov 1920.

Diseased specimens of the Douglas Fir (*Pseudotsuga Douglasii*) were collected in Perthshire and were found to be attacked by *Botrytis Douglasii*; a disease which is widespread on the Continent, but which up to the present does not appear to have been recorded in Scotland. The specimens which were taken from the lateral branches of a tree about 18 years old, have a very characteristic appearance. The terminal portion of the shoot is brown and withered, and the stem, as a result of the attack of the fungus, loses its rigidity and bends over a few inches behind the apex, from 4 to 6 in., of the branch are killed. The brown leaves near the apex usually persist, but those further back fall, and the bent portion of the stem is generally bare. The delicate grey mycelium of the fungus, which can be seen with a lens, produces during the summer, numerous conidia, which germinate at once in water and infect the young developing shoots and needles. In the autumn small black sclerotia are produced, and burst through the bark often under the old bud scales. These sclerotia, if kept in a damp atmosphere, produce numerous branched conidiophores which bear large numbers of conidia.

It is probable that *B. Douglasii* is identical with the common saprophytic mould *B. cinerea*

Several investigators have shown that this saprophyte is capable of growing as a parasite on silver fir, larch, spruce as well as *Ps. Douglasii*, and it has been notified on the larch and Scotch pine (*Pinus sylvestris*) in England.

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(1) See *R*, Jan. 1921, No. 110. (*Ed*)

Under damp conditions, it spreads rapidly and may cause considerable damage.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

347 - **New Aphids Discovered in Italy.** — DEL GUERCIO, G., in *Redia*, Vol. XIV, Parts 1 and 2, pp. 107-136, 1 plate. Florence, February 10, 1921.

Observations on the morphology and systematic position of 9 species and 2 genera of aphids that the author describes as new to science. Together with the new species, the author mentions two others already known to science, and which he places in the genus *Eucarazzia*, that he has just created, beside those insects he describes for the first time:—

1) *Rhopalosiphum trilineatum* n. sp., collected from chrysanthemums in the Val di Nievole, and the Valley of Montecatini.

2) *Anuraphis fasciatus* n. sp., found on lucerne in the above-mentioned localities.

3) *Anuriella dorsolineata* n. gen. and n. sp., also found in the above places.

4) *Pentaphis viridescens* n. sp., on the rhizomes of couchgrass (*Agropyrum repens*) in the Cascine at Florence.

5) *Pentaphis apuliae* n. sp., found in the meadows of St. Cecilia (Foggia)

6) *Tetraneura reticulata* n. sp., found under the same circumstances.

7) *T. flavescens* n. sp., on wild barley in the neighbourhood of Florence.

8) *T. agnesii* n. sp., on the flowers of the olive in the Province of Porto-Maurizio.

9) *Eucarazzia picta* n. gen. and n. sp., on the leaves of field calamint (*C. Acinos*) at Acicastello (Catania).

10) *E. calthae* (Koch) (*Rhopalosiphum calthae* Koch).

11) *E. najadum* (Koch) (*Rh. najadum* Koch).

348 - **New Weevils Injurious to Various Cultivated Plants in Africa, Asia and Oceania.** — MARSHALL, G. A. K., in *Bulletin of Entomological Research*, Vol. XI, Pt. 3, pp. 271-278, pl. 1. London, Dec. 1920.

Description of the following Curculonideae:

1) *Tanymecus destructor* n. sp., injurious to maize, and sweet potato in S. Rhodesia;

2) *T. agricola*, injurious to maize in S. Rhodesia;

3) *Isaniris ater*, occurs very commonly on trees of the genus *Brachystegia*, and also attacks various cultivated plants, including citrons, in S. Rhodesia and Nyasaland.

4) *Systates exaptus*, commonly found on different herbaceous plants; appreciable injury caused to young maize plants in S. Rhodesia;

5) *S. chirindensis*, found on leaves of coffee bushes in S. Rhodesia;

6) *Calandra shoreae*, attacks seeds of the sal tree (*Shorea robusta*) as well as those of *Dipterocarpus turbinatus*, in Mauritius and various parts of India;

7) *C. glandium*, bred from acorns of *Quercus incana* and *Q. dilitata* in various parts of India;

8) *Stenommatus musae*, found breeding in the corm of a banana plant in the Hawaiian Islands.

349 - **The Hymenopteron *Opius fletcheri* as a Parasite of the Melon Fly (*Bactrocera cucurbitae*) a Dipteron Injurious to Various Cultivated Cucurbitaceae, in the Hawaiian Islands.** — WILLARD, H F, in *Journal of Agricultural Research*, Vol XX, No 6, pp 423-438, figs 13 Washington D C, Dec 15, 1920.

The braconid parasite *Opius fletcheri* Silvestri was introduced into the Hawaiian Islands from India in May, 1916 to destroy the Melonfly (*Bactrocera cucurbitae* Coquillet) which had been causing great losses to vegetable growers of the islands. *B. cucurbitae* is the only host which *O. fletcheri* attacks freely under field conditions, although the hymenopteron can be bred freely in the laboratory from the Mediterranean fruit fly (*Ceratitis capitata* Wiedemann). However, from many thousands of *C. capitata*, secured from fruits collected in the field, only four adult *O. fletcheri* have been reared.

The author gives a detailed description both morphological and biological of this hymenopteron. Since its introduction into the Hawaiian Islands it has become firmly established on all the larger islands of the group, and has shown itself capable or reducing the number of *B. cucurbitae* by at least 25 %, even when the host larvae are developing in fruits the size and nature of which makes parasitism difficult In a location, where fruits and conditions are most favourable to its reproduction, it has reduced the flies so greatly that they have almost ceased to be a pest.

350 - **Poultry as a Means of Checking Insect Pests in Fruit Orchards.**— See No. 325 of this *Review*.

351 - **Chloropicrin as an Insecticide for the Destruction of Seed Parasites.**— See No. 265 of this *Review*

352 - ***Alcides leucogrammus*, Coleopteron Injurious to the French Bean and to *Vigna Catjang* in Rhodesia.** — JACK, R. W., in *The Rhodesia Agricultural Journal*, Vol XVII, No 5, pp 452-455, pl 2. Salisbury, Oct 1920.

Since 1913, where it was observed in a garden near Old Umtali, the Curculionidae *Alcides leucogrammus* Erich (Bean Stem Weevil) has appeared annually on the experimental plots at Salisbury, and has been observed on farms in different parts of Mashonaland.

It has only been found attacking French beans and Cow peas (*Vigna Catjang*).

The beetles feed mainly upon the stems and branches of the host plants in which they cut longitudinal grooves. The eggs are laid in cavities at the base of the stems; these are first prepared by means of the mouth parts. The larva feeds on the tissues at the base of the stem, several commonly being found on one plant, and considerable swelling, often accompanied by the formation of callus, results. When only one larva is present, it is often entirely enclosed in the swollen stem and callus may not form to any great extent; but when, as is often the case, several are present, some are only partially buried in the stem and much callus may be present.

A plant may apparently carry one grub without actually dying, but its growth and production are seriously interfered with. Many plants are killed outright and others become yellow, drop their leaves and die more slowly.

After describing the stages and habits of the weevil, the author states that no parasites have been bred from the grubs. Observations in the field, have, however, indicated considerable destruction by natural enemies, of the pupae or resting adults, and probably also the larvae. The driver ant *Dorylus helvolus* appears to be the chief enemy in this respect.

All plants subject to attack should be pulled up and burnt.

353 - ***Earias insulana*, var. *anthrophilana*, a Macrolepidopteron Parasitic on the Cotton Plant and on "Gombo" *(Hibiscus esculentus)* in Cyrenaica.** — ZANON, V, in the *Rivista di Agricoltura*, Year XXVI, Nos. 1 and 2, pp. 5 and 23-24. Parma, 1921.

In 1919, a regular invasion of the macrolepidopteron *Earias insulana* var. *anthophilana* was reported from Benghasi, where it had attacked *Hibiscus esculentus*. In preceding years, this insect had also been found in Benghasi, and had done a certain amount of injury to cotton (*Gossypium barbadense*).

In both cases, the caterpillars injured the fruits more or less, so that the crop was considerably damaged.

It is certain that, in Cyrenaica, there are two generations of *Earias insulana* on the two host plants: if the season is good there is a third, but this confines itself to the *Hibiscus*.

As a control measure, it has been advised, in Upper Egypt, to keep all Malvaceae as far as possible from the cotton plantations. The author, on the other hand, suggests that *H. esculentus* should be sown very early near the fields of cotton, for since its fruits are much tenderer and earlier than those of the latter plant, it would attract the first generation of insects. After the moths have laid their eggs, all the "gombo" fruits should be gathered, and the plants pulled up, before the insects are able to assume their adult form.

354 - **The Tobacco Slug (*Lema bilineata*) in South Africa.** — VAN DER MERWE, C P., in *Union of South Africa, Journal of the Department of Agriculture*, Vol. II, No. 1, pp. 28-38, figs. 3. Pretoria, Jan 1921.

Since 1911, the slug *Lema bilineata* Germar, has been observed several times in Natal, also in the Orange Free State, in the Cape Province, and in Swaziland. Its native home appears to be in South America and it is likely now to become a serious pest from the commercial standpoint as regards tobacco cultivation in South Africa.

This beetle is popularly termed tobacco leaf slug and has the habit of attacking the tobacco in the seed beds, field, curing sheds and even in the bales.

In the field, the lower side of the leaves are attacked by the larvae, in close masses. Later, they separate and eat large ragged holes in the leaf. If many larvae are present on a leaf, in a short time only the midrib and a few large side ribs will be left. In the seedbeds, the mode of attack is similar; the central plants which are close together being attacked first. In some cases, half the plants have been destroyed, dozens of larvae being found on every leaf, and in other places, the plants, both in the seedbeds and in the fields, were completely destroyed. The tobacco is only attacked in the curing sheds and in the bales when still green. In the Piet Relief District, the custom is to cut the whole plant and hang it up in the shed to dry, which demands more than a month, and there is, therefore, time for larvae to develop to maturity. The damage done in sheds is very great, and perhaps relatively greater than in the field, as the insects are better protected from natural enemies and unfavourable climatic conditions. Such damage can be prevented by other methods of drying, but it is thought the damage in the shed will be trifling if the pest is properly controlled in the field.

The author gives a detailed morphological and biological description of the insect and its various stages and habits.

In Durban the possible maximum number of generations in the year appears to be eight. Besides on tobacco, the slugs have been observed to feed on *Physalis* spp. *Nicandria physaloides, Datura Stramonium* and *D. Tatula*. At Cedara, it occurs on potatoes. The adults appear to have the same food plants as the larvae, but they are not so voracious and do not do so much damage.

As regards means of distribution, the greatest danger appears to lie in transported bales of tobacco. According to certain reports the pest is greatly favoured by wet weather and moist soil.

Amongst the natural enemies, may be mentioned, in order of importance, the ants *Pheidole punctulata* and *Myrmicaria eumenoides;* and amongst the Rhynchotes different species of the fam. Reduvidae have been seen attacking both beetles and slugs.

A spider has been observed carrying off both young larvae and adults of *L. bilineata*. Chickens and turkeys willingly eat the larvae. Cocoons have been found eaten out, apparently by a rat or a mouse.

Several control measures have been tried with success, *e. g.* hand crushing; spraying with arsenate of lead (in paste form 2 lb. of paste in 50 gall of water and in dry powder 1lb. in 25 gall. of water; the powder is generally preferable to the paste); dusting with arsenate of lead powder; dipping young tobacco plants before setting out in the field in arsenate of lead and water of the strength recommended for spraying.

355 - **Tamarind Pod-Borer, *Sitophilus linearis* in the United States.** — COTTON, R. T, in *Journal of Agricultural Research*, Vol. XX, No. 6, pp. 439-446; pl. 1. Washington, D. C., Dec. 15, 1920.

The literature of North American entomology contains occasional reference to the curculionid beetle *Sitophilus linearis* (Herbst), but nothing definite has been published regarding the biology of this weevil or the extent of its distribution in the United States.

The tamarind pod-borer was described in 1797 from specimens obtained from the West Indies, where the weevil had been introduced with its food plant, the tamarind. It is undoubtedly indigenous to India, but has now spread to all places where the tamarind is grown. In 1892 CASEY noted the occurrence of *S. linearis* in North America, but in 1895 CHITTENDEN stated that in his opinion *S. linearis* should not be inserted in the North American fauna list until it could be ascertained that the species actually bred in some plant within the faunal limits. Up to the present, records of its occurrence in the United States refer to occasional specimens picked up in the Southern Atlantic and Gulf States, which had undoubtedly been imported in shipments of tamarind pods. The author has found it to be exceedingly abundant in southern Florida, where the tamarind is now grown , there is, therefore, no longer any doubt that it is well installed within the North American faunal limits.

In 1916, this species was notified as causing considerable damage to the pods of the tamarind in Jamaica and even in India. The weevil is now known to occur in the United States, India, Brazil, Mexico, Ecuador, Jamaica, Montserrat, St. Bartholomew, Cuba and Costa Rica It occurs, undoubtedly, wherever the tamarind is grown.

The attack is confined entirely to the seed pods ; the adult weevils feed little, but the larvae bore in the seeds or beans and reduce them to powder. The entire crop is frequently completely destroyed unless promptly harvested and protected.

Descriptive notes are given of the egg, mature larva, larval instars and of the pupa and of the life history, and biology according to observations made in Florida.

No parasites have up till now been reared from any of the stages of *S. linearis*. Larval and pupal stages were attacked and killed in the laboratory by a predacious mite, *Pediculoides ventricosus* Newport. It seems very doubtful, however, that this mite would be able to penetrate to the larval burrows under field conditions.

356 – ***Rhabdopterus picipes*, Coleoptera Injurious to the Apple in the New York State.** — SAWYER, W. S, in *The Canadian Entomologist*, Vol. LII, No 12, p. 265, pl. 1. London, Dec. 1920

On June 28, 1920, in an orchard near Sodus (New York), large numbers of *Rhabdopterus picipes* Oliv. were found feeding on apples, especially variety Grimes Golden, eating out a shallow, irregular, hieroglyphic like channel on the surface. About 75 % of the apples were injured in this manner.

The beetles continued feeding until the middle of July, after which time they were found feeding on the foliage of *Vitis hederacea*, *Rumex* and wild strawberry. Apple leaves were not attacked.

When feeding on the foliage, holes were made similar to the channels on the fruits ; in some cases riddling the leaves so that only the veins remained. About August 1, the beetles disappeared.

In 1920, the work of the insect seemed to be confined to the vicinity of Sodus and Savannah (New York). In the latter place it was most abundant on the foliage of wild strawberry and *Rumex*. The damage to the apples in this locality was not great.

Attempts to kill the beetles by spraying with arsenate of lead were not successful.

INJURIOUS VERTEBRATES

357 - **Toxicity of Barium Carbonate to Rats.** — SCHWARTZE, E. W. (Pharmacological Laboratory), in *United States Department of Agriculture, Bulletin* No 915, pp. 1-11, tables 10, bibliogr of 20 works Washington, D. C., Nov. 12, 1920.

A series of experiments on the toxicity of various substances to rats, and their suitability as poisons was undertaken in 1918, at the request of the Bureau of Biological Survey of the United States Department of Agriculture, for the purpose of obtaining toxological data for use in connection with the rat-extermination work in the zone of occupation of the American Expeditionary Forces. These studies have been continued because of their importance to agricultural economics as well as to the public health.

In the experiments here reported the brown rat was used as often as practicable, and the domesticated white strain was employed for obtaining accurate food-intake data, and for testing the relative efficiency of different percentages of barium carbonate in the bait. The barium chloride administered was the ordinary crystalised salt ($Ba\ Cl_2 . 2\ H_2O$). The carbonate, which was of high purity and free from soluble chloride, was always used in the form of fine powder, having been passed through a 100 mesh sieve.

The subcutaneous lethal dose of barium chloride was from 45 to 89 mg. per kilo and the oral lethal dose from 355 to 535 mg. per kilo. The results of the 2 sets of experiments, given in the order of the barium intake per kilo, are in general agreement, the efficient lethal dose of barium carbonate being from 630 to 750 mg. per kilo. On the basis of the barium content, the carbonate is about $^2/_3$ as active as the chloride.

The average intake of food, both poisoned and unpoisoned, by hungry white rats used in these tests was $^1/_{200}$ of their body weight.

An efficient concentration of barium carbonate in the rat bait was 20 %. With this percentage, a rat is required to eat only $^1/_3$ or $^3/_8$ of a meal of average size, or $^1/_{320}$ to $^1/_{266}$ of its own weight, in order to secure the ingestion of a lethal amount. With this concentration, many of the rats die within the first 24 hours, the chief factor being the consumption of an amount larger than the minimum efficient lethal dose. From the results of both the pharmacological and the feeding tests, it would not seem advisable always to expect 100 % mortality from the administration of barium carbonate to rats in proper amounts

[350-357]

ALFREDO RUGGERI, *gerente responsabile.*

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

358 - **Agriculture in Julian Venetia** (1). — TAMARO, D., in the *Giornale di Agricoltura della Domenica*, Year XXX, No. 43, p. 137. Piacenza, Oct. 24, 1920.

Agriculture is practised in Julian Venetia under natural conditions that are common to a number of regions in Italy. The conditions of the coastal zones differ but little from those of Liguria, except that rainfall is less abundant and not so well distributed. The coast from Trieste to Salvore is swept more often by the "bora", a strong N-E-E wind. The myrtle flourishes at Miramare: the coastal hills are covered with olive trees as far as Salvore; laurels abound at Abbazia, and palms flourish in the Brioni islands and at Lupino. This favoured zone of Julian Venetia represents a fifth of the cultivated area.

Between Gorizia and the sea, *i. e.*, in Eastern Friouli (62,000 hectares in area), where the climate is temperate, grain is cultivated, in regular rotation with artificial meadows and hoed crops. Other alluvial soils are found in Istria along the banks of various rivers, and these soils, as at Capodistria, Isola, and Pirano, are covered with vines, fruit trees, and vegetable gardens. The land around the Arsa and Orvieto rivers require improvement to stamp out malaria. These improvements would enable the whole of Istria to be given an adequate supply of drinking and irrigation water.

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(1) See: DOMENICO TAMARO. L'Agricoltura della Venezia Giulia. Casalmonferrato, 1920. GIOTTO DAINELLI. La Dalmazia. Novare, Ist. Geogr. de Agostini, 1918 (*Ed.*)

[Abstract No. 358]

Seventy per cent. of the cultivated land consists of "terre rosse" (red earth), *i, e.*, the Carso zone (566,000 hectares) comprising the islands of Carnaro, and reappearing between Fiume and Fianona. At an altitude of 1000 metres this zone extends in a northwesterly direction, occuping most of Istria, Trieste, Postumia, Longatico and, as it nears the Isonzo, slowly drops, occuping part of the districts of Gorizia, Gradisca, and Tolmino, and ends by mingling with jurassic and triassic formations.

The Carso consists of plateaux and hilly, undulating terraces, with soils derived from eocene formations collected in deep pockets and forming veritable oases covered with luxuriant vegetation, which is often dried up in summer. In Istria, at an altitude of 350 metres, the olive and other fruit trees are grown in these soils, more or less associated with cereal crops which, in their turn are grown on fallow land in order to conserve soil moisture. Above this altitude, meadows and woods predominate, with vast areas under cereals and potatoes.

The productive agricultural land of Julian Venetia covers about 800.000 hectares and represents 94 % of the total area. In 1913, the distribution of the various crops was as follows:

250 000 hectares of pasture crop value 55 200 000 *lire ;*
222 000 » of wood crop value 11 100 000 *lire ;*
120 000 » of plough and hand-worked land, crop value 78 800 000 *lire ;*
100 000 » of meadow and alpine pastures, crop value 23 200 000 *lire ;*
55 000 » of vineyards, crop value 31 700 000 *lire ;*
53 000 » comprising the districts of Postumia, Longatico, and Idria.

The agricultural produce was thus worth 200 million *lire*, or 267 *lire* per hectare.

The number of head of livestock in 1913 was 140 000 cattle, 250 000 sheep and goats, 60 000 pigs, and 10 500 horses. These animals gave a weight of 5 quintals per hectare, 6 quintals per hectare in Istria, and 5 in Gorizia. The fodder obtained from rotation meadows, permanent meadows, and from pastures, including forest pastures, gave, as hay, 10.2 million quintals. The ratio between tilled and meadow and pasture land is 1 : 3.5, and corresponds to that of the best agricultural countries; thus there should be a very high unit yield of grain, if, especially in Istria, it were not for the arid soils in the Carso, as these receive abundant rain in autumn and winter, but very little in summer.

The Istrian cattle are of the podolian type improved by crossing with the romagnol breed, whereas on the platean of Gorizia, the Simmenthal breed has been introduced. The mountainous zone of Gorizia possesses the alpine type, which gives good milch cows. The number of sheep is very great, especially in Istria, for the poor Carsic pastures can only be utilised by sheep. In Istria the goats have providentially disappeared except amongst the rocky mountain tops.

The forest produce is valued at a low figure, because no proper management has been applied save in the forests of Gorizia, Postumia, Longatico, and in certain other centres, such as Montona, in Istria The war wrecked most of the reforestation which had been effected with such difficulty on the Triestine Carso and reconstitution is urgently required. The average wheat crop is 10 quintals per hectare with a minumum of 8 quintals in Istria, and a maximum of 14 quintals in Gorizia. In Istria, maize yields 9.5 quintals per hectare, and Gorizia 22.6 quintals. The same difference in unit yield is seen between the two provinces for all the other types of crops, as is shown in the following table :

Average unit production of herbaceous crops in the provinces of Istria and Gorizia.

Plant	Total area cultivated in the two provinces	Total production in the two provinces	Average production in cwt per hectare	
			Istria	Gorizia
	Hectares	Quintals		
Wheat, Barley, Oats, Rye .	32 550	288 000	8	14
Maize	93 973	91 000	9 5	22.6
Potatoes.	13 657	1 214 000	55	141
Pulse	4 354	34 000	7.4	10
Rotation hay	12 527	680 000	45	61

Istria suffers from drought to such an extent that even drinking water is scarce, and it is for this reason that rotation meadows are too little developed and fallow crops predominate.

But, in Istria there are 46 434 hectares under vines either alone or grown in conjunction with the olive tree and with cereals. In the neighbourhood of Trieste, the vine is not only cultivated with the olive but with other fruit trees as well as vegetables. The cultivation, associated or separate, of vegetables and fruit trees is equally intensive around Gorizia, whilst, in the Friouli plain, the crops are grown in fields planted with lines of mulberry trees, where three and four year rotations, are carried out and where there is excellent pasturage in the Alps. Under the old régime, more attention was paid to forestry than to agriculture, but less than in the other countries which formed the former Austrian Empire. Agriculture in this region was directed by a central inspectorat with head quarters at Trieste, and on which the chair of agriculture of each district was dependant. In Istria, however, a provincial law was passed instituting an Agricultural Council, whose president was nominated by the Government. The Province of Gorizia had an agricultural inspector nominated by the province who is still in office.

359 - **Agricultural Possibilities in Ceylon.** — *The Tropical Agriculturist*, vol. LVI, No. 1 pp. 1-2. Peradeniya, Ceylon, Jan. 1921.

The possibilities of establishing and extending other industries in Ceylon is at present a subject much discussed. Although tea, rubber, and coconuts form the bulk of exports, these are, however, other export industries that occupy comparatively important positions in certain areas of this colony.

Experiments carried out several years ago at Hakgala and at Peradeniya demonstrated the possibilities of cultivating camphor on higher elevations. Considerable areas of this crop were covered, but the greater portion has since been cut out and replaced by tea or timber. Now that the price for tea has fallen and the price for camphor has risen and according to information from reliable sources, is likely to remain high the cultivation of this product is worthy of reconsideration.

Sisal (*Agave* sp.) has been demonstrated at the Anuradhapura Experiment Station to be a crop with possibilities for the dry zone, and a syndicate has undertaken the cultivation of this fibre upon estate lines. There are good prospects for this fibre and for *Furcraea* as a crop for the small cultivator.

The most promising results with regard to cotton cultivation have been obtained from certain areas of the Southern Province, and provision is being made for a trial upon a commercial scale of various varieties; and for the inauguration of a purchase scheme for peasant grown cotton.

The *robusta* types of coffee are being extended. Plants of known percentage for selected seed bearers in Java have been secured during the past few years and are now coming into bearing

Trials are being made at Anuradhapura with oil palms introduced from West Africa. It is considered possible that this oil producing crop may offer favourable prospects for cultivation upon lands not suited for coconuts.

Other crops that deserve the closest investigation in Ceylon are sugar and limes. The former can be grown with profit and with careful cultivation, high yields can be secured. The establishment of sugar cane cultivation upon estate scale is a necessity under the present conditions, although it may also prove a profitable proceeding for small holders who supply canes to a central factory. Limes grow and yield excellently in many parts of the colony, and it has already been demonstrated in the West Indies that this crop is a profitable one.

There are many additional crops which can be added to those at present under cultivation. Definite experiments are, however, essential at the start, and the establishment of an increased number of experiment stations under trained supervision is necessary.

360 - **Tsetse-Flies in French West Africa.** — ROUBARD, E (Head of the Laboratory of the Pasteur Institute in Paris), in the *Bulletin du Comité d'Etudes historiques et scientifiques de l'Afrique Occidentale française*, No. 4, pp. 257-300, 7 fig. + 1 map. Paris, July-September, 1920.

The author studies successively:

I. — The tsetse-flies (*Glossinae*) of West Africa.

(*a*) General biological characters

(*b*) The different species; their characteristics.

The author distinguishes small species of less than 10.5 mm in length and large ones which are longer. Amongst the first, he mentions the *palpalis* group (*Gl. palpalis, Gl. pallicera, Gl. tachinoides*) and the *morsitans* group (*Gl. morsitans, Gl. longipalpis*). He identified in F. W. A the following members of the second group: — *Gl. fusca, Gl. nigrofusca, Gl tabaniformis*, and *Gl. medicorum.*

(*c*) The habitat of the flies, biological and geographical conditions;

(*d*) The tsetse-fly zones in F. W A.

(*e*) The seasonal migrations of the flies The periodical variations in their geographical distribution due to meteorological conditions

(*f*) Effect of geographical and geological conditions. Correlation between flies and soil.

(*g*) Connection between *Glossinae* and the vegetative and climatic zones of F. W. A. Geographical breeds.

II. — The flies and their relation to diseases caused by trypanosomes in West Africa.

a) Variations in the resistance of different species of animals to the tsetse-fly.

(*b*) Effect of cattle in protecting man from *Glossinae*

(*c*) Biogeographical relations between tsetse-flies and trypanosomes

(*d*) Geographical races of the flies and their virus. Relatively slight danger of the spread of sleeping-sickness in French West Africa.

(*e*) The control of tsetse-flies.

CORPS AND CULTIVATION

361 - **Phenological Observation and Studies in Holland.** — Bos H., in *Cultura*, Year 30, No, 364, pp. 363-379 and Year 33, No. 388, pp 12-22. Utrecht, January, 1921.

The phenoscopic data collected each year in a network of specially-chosen Stations distributed throughout Holland are published by the author. The list of these Stations is as follows: — Balfo, Sexbierum, Groningen, Leeu-Warden, Bergum, Winschoten, Zeegse, Texel, Dalen, Hoorn, Alkmaer, Harderwijk, Naarden, Enschede, Amersfoort, Warsnsveld, Utrecht, The Hague, Rosendaal, Velp, Arnhem, Wageningen, Zetten, Rotterdam, Kapel Avezaath, Malden, Middelbrug, Waterlandkerkje, Schinnen, Nuth, Maëstricht, Gronsveld.

The trees and plants examined are: —

Corylus Avellana, Aesculus Hippocastanum, Ribes rubrum, Betula alba, Prunus avium, Prunus spinosa, Prunus Cerasus, Prunus Padus, Pyrus communis, Fagus sylvatica, Syringa vulgaris, Narcissus poeticus, Crataegus Oxyacantha, Spartium scoparium, Quercus pedunculata, Cytisus Laburnum, Sorbus aucuparia, Cydonia vulgaris, Sambucus nigra, Secale cereale hibernum, Rubus Idaeus, Symphoricarpus racemosa, Salvia *officinalis, Cornus sanguinea, Ligustrum vulgare, Tilia grandifolia, Tilia parvifolia,* and *Lilium candidum.*

The following vegetative phases were noted and registered: —

1) Coming into leaf. On the same tree of average earliness the upper surfaces of the leaves begin to show themselves in certain places.

2) Unfolding of the first flowers.

3) Ripening of the first fruits.

4) Date when most of the leaf-buds are unfolded and the tree becomes green.

5) Date when the leaves begin to assume their autumn tints.

The phenoscopic data collected each year are suitably commentated upon and sometimes form the subject of special publications

As regards the annual commentaries for 1920, the season seems to have been characterised by early flowering owing to the high temperatures in March This early blossoming was especially noticeable in the cases of *Prunus Cerasus, P. Padus, P. spinosa, Cytisus Laburnum, Sorbus aucuparia,* and *Prunus avium.* It is clearly shown that the increase, or rather the height, of the temperature does not affect different plants in the same manner or to an equal extent.

Acer Pseudoplatanus, though its buds swell and open early, at least as far as can be judged from some individuals was rather late in 1920, whereas the planes, which are much later budded soner.

Fraxinus excelsior, of which the phenoscopic periodicity is but little accentuated, was very late, as if the favourable thermic conditions had no effect upon it, *Wistaria* behaved in a similar manner, only flowering at the same time as *Cytisus Laburnum* (the latter, a much later tree, flowered a fortnight earlier than usual).

In April, another fall in the temperature occurred that, in the case of a number of plants, prolonged the foliation and flowering periods. The apple-trees remained in flower for over a month. From May 9 to 11, the temperature fell again considerably. The author mentions, in this connection, a work by SCHIERBEEK, who attributes the cold spell that prevailed throughout a great part of Central Europe from May 10 to 15 to the influence of the energetic renewal of growth on the part of the majority of plants. He is of opinion that the fall in temperature was due to the transpiration of the large mass of foliage which came, almost suddenly, into contact with the surrounding atmosphere.

As the season progresses, the earliness of the phenologic phenomena gradually diminishes until, towards the middle of the summer, the date of the vegetation phases tends to become normal. On the other hand, there is an advance in the appearance of the autumnal tints on the leaves.

As was said above, the data collected sometimes serve as the subjects of special studies and monographs. An article by the same author on the rye harvest in Holland has been included in one of these publications He made use of the documents of 2-8 Stations, and the data refer to periods of information ranging from a minimum of 3 years, to a maximum of 24.

Average Data for Each Place.

Localities	Date	Years of observation
1) Maestricht	15 $^{13}/_{20}$ July	16
2) Rosendaal	16 »	8
3) Suippeling	16 $^{2}/_{25}$ »	19
4) Driebergen	16 $^{1}/_{3}$ »	6
5) Gronsveld	18 »	3
6) Arnhem	18 $^{8}/_{25}$ »	18
7) Aalten	18 $^{1}/_{3}$ »	3
8) Z.-Barge	18 $^{2}/_{3}$ »	6
9) Zuften	18 $^{7}/_{10}$ »	8
10) Wageningen	19 $^{6}/_{25}$ »	18
11) Nuth	19 $^{2}/_{5}$ »	5
12) Dalen	19 $^{1}/_{2}$ »	4
13) Hulst	19 $^{1}/_{2}$ »	4
14) Heerlen	20 »	7
15) Harderwijk	21 $^{6}/_{25}$ »	24
16) Zevenhuizen	21 $^{7}/_{9}$ »	9
17) Groningen	22 $^{11}/_{45}$ »	9
18) Vuilkcl	22 $^{1}/_{4}$ »	4
19) Rolde	22 $^{4}/_{9}$ »	9
20) Schinnen	22 $^{6}/_{7}$ »	7
21) Oudenbosch	23 »	11
22) Uithuizermeeden	23 $^{1}/_{5}$ »	11
23) Ubrum	23 $^{19}/_{25}$ »	6
24) Utrecht	23 $^{2}/_{5}$ »	6
25) Midwolde	24 »	4
26) Winsum	24 $^{2}/_{25}$ »	22
27) Alkmaar	7 August	6
28) Texel	7 »	10

The geographical position of the Station (its latitude and longitude) undoubtedly have an influence upon the date of the ripening of the rye, and hence upon the time of the harvest.

Complete maturity is reached first in the southern districts, the South-East sector being the earliest ; the harvests ripen progresively later as one passes northwards, the latest crops being in the North-West sector (Alkmaar, Texel).

There are, however, many other factors besides geographical position, which have a decided influence upon the date at which the crops are ripe. The numerous errors in the comparative estimation of the data are due to : —

(1) The race, kind, or variety of rye in question ; thus, a *late* variety may ripen at the same time or later in the south, as an early one in the north. The data given in the present article all refer to local varieties or to the variety known as " Petkuser ".

(2) *Agro-geological conditions.* — In soils rich in water and nitrogen, cereals reach maturity more slowly than in poor sandy land. It

is therefore advisable to carry out the observation work under special conditions, which would give the highest comparative value to the phenoscopic averages obtained. This could be done by the institution of a " Phenological Society ", provided its statutes and regulations were scrupulously observed by the members.

As regards the date of maturity in the case of rye, the author has for many years classed the different seasons under the respective heads of average, late, and early.

An average result may, however, be due to two very different causes: —

(1) The crops may have ripened at an average date in all the localities.

(2) On the other hand, the average may be due to early ripening in some Stations, and late ripening in others. In the second case, the author proposes to substitute the term " mixed season " for " average season ". It has been observed that the differences between the dates of the harvest in the extreme localities are less in early than in late years.

362 - Weather Conditions in South Florida Relative to the Cultivation of Sugar Cane.

— CHANGE. G. M., in *Sugar*, Vol 22, No. 12, pp. 689-690. New York, Dec. 1920.

Apart from the injurious effect of the north and north westerly winds which occasionally prevail, the climate of South Florida is, taken as a whole, favourable to the cultivation of sugar cane.

The period without frost lasts 2 months longer than in Louisiana, resulting in an average increased length of cane maturity.

In studying the effect of frosts in the open field, the author has noted that the cane already resists well; mature canes only may suffer damage and those ready for milling.

In any case, frosts, even though not essentially destructive, should be taken into account.

As a means of control, the author suggests a system of flooding the land to get practical immunity from frosts.

As regards resistant varieties, D 74 is recommended, which has already given good results.

A cross between D 74 and a very hardy Japanese variety should prove of value in Florida. Such a cross has been made, but its practical value has not yet been demonstrated

363 - Theory of Injury Due to Freezing of Fruit Buds from the Protection Standpoint.

— WEST, F. L. and EDLEFSEN, N. E. (Utah Experiment Station), in *Journal of Agricultural Research*, Vol. XX. No. 8, pp. 665-662, pl. 1. Washington, D. C. Jan. 15, 1921.

INTRODUCTION. — The late spring frosts and the early autumn frosts cause damage to the extent of several millions of dollars annually in the United States. The commonest method of protection is to heat by burning oil in pots distributed through the section that is endangered. This method is resorted to on a large scale in the citrus fruit sections of California, and less frequently elsewhere for the protection of such fruits as apples, peaches and cherries.

The success of this practice depends on the economical use of fuel and labour, and it can only be employed in cases of urgent need.

If the predicted minimum temperature is lower than the " critical temperature " or if the predicted minimum temperature is above the " critical temperature ", in both cases it is useless to light the heaters.

It is, therefore, indispensable to know first the degree of resistance of the fruits trees at various stages in their development. Thanks to the previous investigations made by other authorities, it has been possible to draw up a classified list of the " danger points " for various kind of fruit: —

1) At the time when the petals are closed but showing colour · — apple 25° F to 27° F; peach, 20° F to 29 F; cherry 22° F to 29° F, pear 25° F to 29° F, plums and apricots 22° F to 30° F.

At time of blossoming: apple and pear 28° F to 29° F, peach 27° F to 30° F, cherry 28° F to 30° F, apricot and plum 28° F to 31° F.

Fruit setting: apple and cherry, 28° to 30; peach 27° to 30°; pear 28° to 29°; plum 28° to 31°, apricot 28° to 32°.

This paper gives the methods used and the results obtained by freezing on 24,000 fruit buds, most of them being apples and peaches, and also observations on the spring temperatures and yields of fruit in orchards near Logan Utah (1913 to 1920).

METHODS EMPLOYED — 1) Detaching branches with fruit buds in the laboratory by means of a specially designed thermostat, the air surrounding the buds being cooled by means of common salt and ice. The extent of the injury was determined by cutting the buds open and counting those that had been damaged and then calculating the percentage frozen.

2) Branches of trees were bent down into a vessel sorrounded by a second air chamber, the latter being surrounded by a mixture of ice and salt. The minimum temperature was noted, the branch tagged, and the further development of the buds was observed and the yield of fruit determined.

3) Modified method No. 2. Instead of using ice and salt, the buds were cooled by means of evaporating liquid carbon dioxide which in a very cold gaseous condition cooled the buds to the desired temperature.

4) Freezing the whole tree by surrounding and covering it with a 2-walled metal vessel containing ice and salt.

The factors that determine the amount of damage done are:

1) Kind of buds.
2) Stage of development.
3) Minimum temperature.
4) Humidity.
5) Duration of frost.
6) Rate of thaw.

RESULTS — General conclusions may be drawn after examination of the numerous experimental data collected in this way.

1) Ben Davis apples in full bloom have experienced temperatures

of 25°, 26° and 27° F without injury, and 25° kills about ½ and 22°F about $^9/_{10}$. On several occasions, however, apples matured on branches at a temperature of 20° F.

2) With Elberta peaches in full bloom, 29° F or above are safe temperatures. A temperature of 28° F will kill from ¼ to ½; 26° F kils ½ and 22° F about $^9/_{10}$.

3) With sweet cherries in full bloom, 30° F is the safe temperature, but 29° F usually kills about ¼ and 25° F about ½.

4) Sour cherries are hardier than the sweet varieties in full bloom 26° F killed only $^1/_5$ and 22° F only $^2/_5$ of them When the buds were showing colour 23° F did not harm them.

Sour cherries are the hardiest, and then follow in order apples, peaches, apricots and sweet cherries.

5) With apricots 29° F is the safe temperature; 26° and 27° F killed about $^1/_5$ and 22° F killed ½ They are, therefore, fairly hardy, but they bloom so early that they are more exposed to the late spring frosts than other fruits.

6) All the foregoing figures refer to the buds when in full bloom. Starting from this stage, the earlier the stage of development the hardier are the buds but when the fruit is setting the injury is from 5 to 10 % more than when they are in full bloom.

364 - The Effect of Frost upon Roots, and the Best Means of Minimising Injury thus Caused. — JENSEN M., in *The Ugeskrift for Landmaend*, Year 65, No. 51, pp 701-703 Copenhagen, December, 1920

The results of investigations and observations made at Hindrerupgaard (Odense, Denmark) regarding the effect of frost upon plants cultivated for their roots, and the best means of lessening the injury they may sustain. According to the greater or less degree of frost, the state of the soil and of the plants, the roots, after a considerable fall in temperature may be in one of the following conditions: —

1) Capable of being lifted as soon as they are thawed, as they can still be stored.

2) So much damaged that they require at least some weeks free from frost, in order to recover.

3) Injured to the extent of being unable to recover, even if the weather be favourable throughout the rest of the winter.

The author gives the following advice based on his own experience: —

1) If the frost has not been too severe, the roots should be lifted as soon as possible after the thaw and put into hemispherical heaps, from ½ to ⅓ of a metre high, in the case of small roots, while in that of large ones, the dimensions of the pile onght to be about double.

The upper layer consists of roots placed one against another, in direct contact; they should be arranged so that the tip of the root is always directed towards the centre of the heap; the leaves being turned outwards, form a protective layer

In this position, roots that have been lifted resist subsequent frosts much better.

2) When, however, the temperature begins to rise, and the cold is not sufficient to harm the plants to any great extent, the author recommends their being left in the ground, for they keep better under this condition. A certain number can be lifted each day, as they are required for feeding the stock.

365 - **The Use of Smoke-Producing Candles to Prevent the Injury Caused by White Frosts.** — ZANNONI I., in *Giornale di Agricoltura della Domenica*, Year XXXI, p. 75. Piacenza, March, 1921.

The material left over from the war has been used in the most different manners and agriculture has not been the last to profit by it. In the English munitions dépôts there are certain contrivances which were intended to hide the troops at the moment of assault by generating dense clouds of smoke that formed a efficient screen allowing the soldiers to carry out their manoeuvres freely.

These were known as *smoke-generating candles* ; during the time they burnt, which was 6 to 8 minutes, they produced a dense smoke, that extended along the ground ; and rose to a greater or less height according to the atmospheric conditions. These so called candles consist of a cylindrical tin box 8 cm. in diameter, and 14 cm. in height; they weigh 1-4 kg., and are ignited by friction.

When the candle is lighted, it burns under considerable pressure, which carries up the smoke to the height of 1 to 2 metres producing a grey gas, that is perfectly innocuous, as the author tested by standing in the midst of the smoke for some minutes. He inhaled it without experiencing the smallest inconvenience. There is thus no fear of the presence of poisonous gases that might injure the plants, as might ave been expected.

It thus seemed possible that these smoke generating candles could well be used instead of the smoke-producing fires lighted by agriculturists in spring, when they fear the effect of white frost upon the crops, especially the most suceptible ones cultivated in kitchen-gardens, orchards, and vineyards.

The experiments lately carried out by the author at the English camp, at Rivalta di Scrivia, show that there is every reason to believe that the innocuous gas generated these smoke producing candles would afford efficient protection to crops when their young buds are threatened with injury by the early morning frosts.

The smoke of the candles forms dense clouds, which can protect the plants for half-an-hour at least, the exact time depending upon the wind and the hygrometric condition of the air. Therefore, if they were lighted from time to time during the hours when frosts were to be apprehended, they would hinder the formation of hoar frost, and prevent any fear of injury. The efficacy of smoke in protecting crops from frost has been tested already in many localities, where it has long been the practice to light fires of straw. The smoke-generating candles should be placed on that side of the field from which the wind is blowing ; they should be put in a single line, and from 20 to 30 metres apart. Fresh ones ought to be lighted every half hour or oftener, according to the atmospheric conditions.

The author proposes to continue his experiments.

366 - **Soil Reaction as Applied to Agriculture** (1). — I. Demolon, A. (Directeur de la Station agronomique de L'Aisne), La réaction des sols, in *Revue scientifique*. Yr. 53, No. 6, pp. 173-177, bibliogr. of 26 works. Paris, May 1920, and in *Journal d'Agriculture pratique*, Year 84. No. 41, p. 294. Paris, Oct. 1920. — II. Mirasol, J. J. (University of Illinois), Aluminium as a Factor in Soil Acidity in *Soil Science*, vol. X, No. 3, pp. 153-193, bibliogr. of 84 works, tables 9, Baltimore M. D. Sept. 1920. — III. Hasenbaumer, J. (Landw. Vers. Stat. Munster in W.). Einfluss der Bodenreaktion auf die Düngung und Fruchtbarkeit der Kulturböden, in *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, Yr. 36. No. 5, pp. 80-81. Berlin, Jan. 29 1921. — IV. Gerhing A., Ueber die Reaktion des Ackerbodens, in *Zentralblatt für die Kunstdünger-Industrie* Yr. 26, No. 4, pp. 37-39, Frankfort, Feb. 1921. — V. Wherry E. T., Soil Acidity and a Feld Method for its Measurements, in *Ecology*, Vol. I, No. 3, pp. 160-173, chart 1, Brooklyn, N. Y., July 1920. — VI. Marchadier and Goujon (Directeur et Chemiste du Laboratoire municipal du Mans), Le problème des engrais, in *La vie agricole et rurale*, Yr. 10, No. 6, pp. 81-84. Paris, Feb. 1921.

I. Soil acidity. — M. Demolon gives a brief outline of the origin and nature of soil acidity, and of chemical and physical methods employed for its determination, from the practical standpoint as regards the microflorae and macroflorae in the ground, as well as the question fertilisers and the importance of improving of calcareous land. Considering the fact that soil acidity will constitute henceforth an important factor in the evaluation of fertility and the most appropriate manure to be applied, the author has considered it appropriate to set before the readers the methods of soil analyses at hand. For practical determination, he recommends the Hutchinson method (addition to the soil of a $^1/_{50}$ normal solution of calcium carbonate in carbonic acid, stirred for 3 hours and titrating the non-absorbed residue by employing methyl orange indicator). This is advised in preference to other chemical methods, including the Veitch method, widely practised in laboratories in America (2).

The question of soil acidity, has been studied for many years, especially in England and the United States; the authors desires that this should also be given due attention elsewhere.

II. Aluminium as a factor in soil acidity (3). — The author starts by a bibliographical summary on all question concerning soil acidity and the presence of aluminium in plants and soil.

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(1) See *R.* 1918 Nos 390, 623, 624, 727 and 1204; R. 1919, Nos. 10, 159, 284, 434, 436, 562, 819 and 1084; R. 1920 Nos. 167, 622, 917 and notes (*N. d. R.*)

(2) Robinson considers that the Veitch lime water method gives good results each time it is employed without any modification of modalities such as length of time, temperature, method of heating and evaporation, mass contact etc (*Soil Science*, vol IX, No, 2, p. 151. Baltimore, Feb. 1920). Of the 5 methods examined by Stephenson, those which were apparently the most in agreement are the Veitch and Tacke methods, preference is given to the second. (Cf. March 1919 No. 284). (*Ed*)

(3) See *R.* 1918, Nos 390 and 727, and *R.* 1919, No. 426. (*Ed.*)

Up till now very little information has been obtained concerning the stimulating or fertilising action of aluminium, and the experiments have given results, both incomplete and unsatisfactory, according to MIRASOL although some aluminium compounds have shown themselves extremely toxic to plants (1).

In the experiments conducted by MIRASOL 3 different types of sour silt loams were employed, all coming from southern Illinois and giving an acid reaction with blue turnsol paper. Their composition is shown in the following table.

		Diameter of particles	Colour of soil		
			Grey	Yellowish grey	Yellow
		mm.	%	%	%
Moisture		—	1.76	1.36	1.61
Gravel		2–1	0.93	1.37	0.00
Sand	large	1.0 –0.5	2.15	1.79	0.21
	medium	0.5 –0.25	5.77	2.57	0.44
	fine	0.25–0.1	10.93	4.09	0.97
	very fine	0.1 –0.05	25.26	20.72	52.35
Lime		0.05–0.005	44.61	50.99	19.54
Clay		< 0.005	10.15	18.45	26.47

The author also gives the chemical analyses of the 3 soils. Evidently all were poor in calcium, rich in aluminium and potash, with an acidity (expressed in lb. of calcium required to 1 acre of soil) equal to 2125, 2813, 2921 respectively for soils Nos. 1, 2, 3.

The experiments were carried out with sweet clover (owing to the antipathy of this plant towards acid soil) to ascertain the following points: 1) the influence of aluminium salts and aluminium hydroxide alone or in combination with calcium carbonate or with superphosphate; 2) the effect of limestone and superphosphate alone and combined; 3) the effect of the removal of some aluminium from the soil; 4) the influence of iron and manganese on soil acidity.

The results of several experiments (the author illustrates the same with excellent photographic plates) indicated that in the absence of calcium compound, aluminium salts were highly toxic to sweet clover when applied in amount chemically equivalent to the acidity of the soil, and fatal when applied in amount chemically equivalent to five times the acidity of the soil. In the presence of calcium silicate, aluminium nitrate was more toxic than aluminium sulphate. Aluminium mono-hydroxide had no effect whatever on the growth of sweet clover when other plant nutrients were supplied in a water soluble form. Calcium carbonate in sufficient amounts corrected the toxicity of aluminium salts by precipitating the aluminium as calcium aluminate. Good results were obtained by applying limestone at a rate equal to the lime requirement, and fair crops were also obtained with 1 ton of superphosphate per acre and good crops with 5 tons per acre.

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(1) See the recent interesting work of STOKLASA and his collaborators relative to the effect of aluminium and magnesium ions on germination and development of plants. *R.* Oct. 1919, No. 1111. (*Ed.*)

These trials combined with acidity determinations following the HOPKIN's method demonstrate that, contrary to the idea prevalent, superphosphate distinctly causes decrease in soil acidity. The best results were obtained by combined applications of limestone and superphosphate.

When the soil was leached with a solution of potassium nitrate, until the leachings were neutral, the results were no less interesting. From the 3 soils in question was extracted 97 to 99 % acidity, 45 to 50 % aluminium, 14 to 24 % iron, and 3 to 9 % manganese originally contained in the soil; on the other hand extraction with water gave, respectively, 7.2 to 12.4 %; 17.7 to 24.7 %; 2.5 to 8.6 % and 1 to 1.5 %.

Sweet clover was sown on 3 plots leached with potassium nitrate, but it was found impossible to obtain good germination and growth on soils Nos. 2 and 3, in spite of the addition of sandy soil to improve the physical condition, or leaching with water to eliminate excess of salts. MIRASOL considers that this shows an obvious strong saline residue in both types of soil, in spite of repeated leachings. It was only on the grey type (originally less acid), that it was possible to grow the sweet clover. This, although it presented a feeble and chlorotic appearance in the pots filled with unleached acid soil with or without the addition of potassium nitrate as a fertiliser, gave on the contrary, different results in pots containing soil, water leached or leached with nitrate solution, and developed strongly.

After an examination of the behaviour of iron and manganese, the author was able to conclude that: 1) apparently aluminium is the determining factor in the acidity of soils, with especial reference to American types; 2) in some acid soils, iron and manganese may become contributing factors (1).

In so far as aluminium is a factor in soil acidity, it is considered that HOPKIN's method (2) is the best one for soil acidity determinations.

III. INFLUENCE OF SOIL ACIDITY ON MANURING AND FERTILITY. — After having made observations on the important part played by soil acidity, HASENBÄUMER states that injury caused by acidity is most evident on heavy soils or those inclined to heaviness, towards springtime, after persistent drought, and results in a yellowing, arrested development and often even in death of barley and oats, and also of potatoes, radishes, cabbages etc.

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(1) See also *R.* July 1918, No. 727. (*Ed*)

(2) See *U. S. Depart. Agr Bur Chem. Bull.*, vol 73, p. 114, Yr. 1903. According, however, to the experiments made by STEPHENSON (see preceding note), the HOPKIN's method gives results much lower than all the others

In order to throw light on the varions stages of reaction in the soil; the author proposes the following colorimetric method (1): 30 kg. of dry soil heated with 100 c. c. of calcium chloride solution at 7.5%, stirred thoroughly for 1 hour; 10 c. c. of the soil then filtered and put into sample tubes; 4-5 drops of alcoholic solution of methyl red added and stirred well; and the colour produced noted:

violet	showing	very strong acid	reaction
carmine	»	strong »	»
vermilion	»	medium »	»
orange	»	weak »	»
pure yellow	»	almost neutral or alkaline	

In the last case another 10 cc. of filtrate was taken and 5 drops of azolitmin solution was added, which after filtering gave a distinctly azure blue tint without any sign of violet or red. The soil was therefore clearly alkaline. In the first case, with reference to violet and carmine and also to vermilion, with heavy soils and in the second case blue for sandy soils the various grades of acidity or alkalinity were obviously injurious to plant growth. The author has notified 300 examples of unhealthy plants and this can be explained by the excess of acidity and alkalinity in the soil.

To combat the acidity it has been found advantageons to apply clay marl. The author experimented on acid soil with mixtures of clay marl (85 %) + calcium carbonate, and noticed that the normal reaction occurred with an application of 17.18 gm. per *morgen* (sq. m. 2553). For this reason it is considered advisable to limit the application in accordance with the determination of soil acidity (2).

Alkaline soils should on the other hand be manured according to chemical and physiological acid reactions (potassic salts or sulphate of ammonia). Moreover calciphilous plants should be grown in order to aliminate the excess of alkalinity as far as possible.

The most evident forms of reaction are: — for sandy soils; weak or alkaline; for sandy loam; neutral; for calcareous and argillaceous soil weak alkaline.

IV. GEHRING draws attention to the fact that although it is well known that injuries are caused by acid reaction of peat soils, very little attention is given to the equally certain fact that the continuous use of a single mineral fertiliser gives rise to variations in soil reaction, which may cause damage unless taken in hand in good time. He states that continued action of lime or sodium nitrate may result in counteracting mechanical action in the soil for some time (Meyer and Mansberg) (1). As regards the prolonged use of sulphate of ammonia, this encourages soil acidity. It is not sufficient to determine the quality of fertiliser but it is necessary also to measure the quantity (Lemmermann).

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(1) KÖNIG and HASENBAUMER testifying to the important bearing of recent scientific soil investigations, draw attention to the fact that the quantitative determination of soil acidity can be made by employing the electrometric method But, in this case, several technical difficulties prevent this method from being put into common practice. This is why they recommend instead the colormetric method with methyl red. (Cf. *Landwirtrchaftliche, Jahrbücher* 1920, vol. 60, No. 2, p. 185) (*Ed.*)

(2) BRIOUX states that in France, the soil in the Caux district is often acid and the custom is to add marl 100 to 400 hl. per hectare every 15 to 20 years, in order to avoid slow and gradual acidification. See *Comptes rendus de l'Académie d'agriculture de France.* Vol. 6, No. 39, p. 934. Paris, Dec. 22, 1920. (*Ed.*)

The author gives practical advice on the alternation of fertiliser applications and supports the Hasenbäumer method described above.

V. Soil acidity and field measure for development. Wherry starts by a discussion in simple terms of the principles of physical chemistry which bear upon soil acidity, and the reasons why the hydrogen-ion concentration (2) should be considered as a highly important feature of solution of any acid substance.

Wherry emphasies the fact that the only really reliable method of determining the said concentration or specific acidity is: 1) by catalysis of an ester; 2) by measurement of the potential due to hydrogen-ion, with a potentiometer (3); 3) by observation of colour changes of indicators whose relations to hydrogen-ion concentration are known. He considers that the salt-solution acidification methods practised are valueless, owing to the fact that the results so obtained are composite, representing both acid originally present + a usually greater quantity produced by the treatment, and would differ widely according to the salt used.

The six indicators which have proved most satisfactory in work with soils are: bromphenol blue, bromcresol purple, bromthymol blue, phenol red, methyl red and phenolpthalein.

The specific acidity or alkalinity of the soil extract is determined by adding first a drop of bromthymol blue to the aqueous extract; if the liquid is coloured green, the reaction is neutral, if yellow it is acid, if blue, alkaline. If acid the process should be repeated with successive indicators.

Indicators	Coloration		
	Acid	Neutral	Alkaline
Bromcresol purple . . .	Yellow —> brown —> magenta	Purple	Purple
Methyl red	Carmine pink —> red —> orange	Yellow	Yellow
Bromphenol blue. . . .	Olive green —> brown —> purple	Bluish purple	Bluish purple

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(1) See *R.* Oct.-Dec. 1919, No. 1086 (*Ed.*)

(2) On the question of the measurement of acidity by hydrogen-ions, See *R.*, Aug. 1918, No. 839, *R.*, April, 1919, No. 436 and *R.* Feb. 1920, No. 167. (*Ed.*)

(3) According to König and Hasenbäumer (see preceding note) the acidity obtained by means of titration is nearly parallel to the hydrogen-ion concentration (*Ed.*)

If an alkaline reaction employ:

Indicators	Acid	Neutral	Alkaline
Phenol red	Pale yellow	Orange	Dark orange —> red —> carmine pink
Phenolphthalein . . .	White	White	Pale mauve —> carmine

This process should be continued until either an intermediate colour or opposing extremes of two overlapping ones are obtained. The specific acidity or alkalinity can then be found at the head of the corresponding column on the coloured chart included in this article.

The author states that in spite of certain limitations this method is capable of giving definite information as to soil reaction in many cases, and the results obtained by the author on a number of species of native plants (1) have been of considerable significance.

VI. PROBLEM OF FERTILISERS. — MARCHANDIER and GOUJON summarise the present situation relative to the effect of soil reaction on plant diseases (1) and point out that although up to now artificial fertilisers have proved of great economic value, the harmful effects due to their use in excess quantities now begin to be realised, plants are becoming less resistant to insect pests and accumulate less gluten, *e. g* durum wheats cultivated on French intensive culture lines, which are much less glutinous than those cultivated on American extensive lines. The authors recommed the application of complete fertilising stimulants especially waste products etc, to counteract this organic weakening effect due to the continuous use of heavy applications of saline fertilisers.

367 - **Plant Distribution around Salt Marshes in Relation to Soil Acidity.** — WHERRY, E T, in *Ecology*, Vol I, No 1, pp 42-48. Brooklyn, N. Y., Jan 1920.

I. — As a result of very many determinations of soil acidity and alkalinity made with plants growing under the widest possible range of physical and climatic conditions, the author states that abundant evidence demonstrates that soil acidity is closely associated with the distribution of native plants An account of a few observations is here given to illustrate the possibilities of this method in throwing light on the significance of peculiar types of plant distribution.

The following species (2) which are found on territory extending from the northern Uplands southwards in New Jersey chiefly along the coastal area, flourished on soils that proved to exhibit on the whole circum neutral reactions. The reaction reached a specific acidity of 10, or a similar specific alkalinity, but rarely less farther than this from the neutral point: —

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(1) See *Fühling's Landwirtschaftliche Zeitung* 1917, p 130 (*Ed*)

(2) The common names in these lists are taken from Britton and Brown's " Illustrated Flora " with a few modifications, technical names are in accordance with the American code, but the synonym is given in cases of recent changes which have not been generally accepted, and the names under the international code are likewise added

List I.

Wood reed-grass (*Cinna arundinacea*)
Slender wild rye (*Elymus striatus*)
Low cyperus (*Cyperus diandrus*)
Woolly sedge (*Carex lanuginosa*)
Starry false solomon's seal (*Vagnera stellata*) (*Smilacina stellata*)
Wide-leaf ladies' tresses (*Ibidium plantagineum*) (*Spiranthes lucida*)
American aspen (*Populus tremuloides*)
Starry campion (*Silene stellata*)
Spreading pearlwort (*Sagina procumbens*)
Blunt-leaf sandwort (*Arenaria [Moehringia] lateriflora*) (*Stellaria borealis*)
Columbine (*Aquilegia canadensis*)
Lyre-leaf rock-cress (*Arabis lyrata*)
American burnet (*Sanguisorba canadensis*)
Swamp wild rose (*Rosa virginiana [lucida]*)
Hog peanut (*Falcata comosa*) (*Amphicarpa monoica*)
Herb Robert (*Geranium [Robertiella] Robertianum*)
Whorled milkwort (*Polygala verticillata*)
Shrubby bittersweet (*Celastrus scandens*)
Northern bugle-weed (*Lycopus uniflorus*)
Pale wild sunflower (*Helianthus giganteus*)

More or less closely associated with these species, are others found also in the coastal area, which grow otherwise only in the pine barren area: —

List II.

Brake (*Pteridium latiusculum = Pteris aquilinum*)
Larger pine-barren club-moss (*Lycopodium adpressum [Chapmanii]*)
Pitch pine (*Pinus rigida*)
Panic grass (*Panicum meridionale*)
Panic grass (*Panicum oricola*) (*variety of preceding*)
Pine-barren cyperus (*Cyperus Torreyi*) (*Cyperus cylindricus*)
Twig-sedge (*Cladium [Mariscus] mariscoides*)
Grass-leaf rush (*Juncus aristulatus*)
Grass-pink orchid (*Limodorum tuberosum*) (*Calopogon pulchellus*)
Early ladies' tresses (*Ibidium vernale*) (*Spiranthes vernalis*)
Southern wild flax (*Linum [Cathartolinum] floridanum*)
Inkberry (*Ilex glabra*)
Sheep laurel (*Kalmia angustifolia*)
Stagger-bush (*Neopieris [Pieris] mariana*) (*Lyonia mariana*)
American cranberry (*Vaccinium [Oxycoccus] macrocarpon*)
White thoroughwort (*Eupatorium album*)
Blazing star (*Lacinaria graminifolia var.*) (*Liatris graminifolia*)
Pine-barren goldenrod (*Solidago fistulosa*)
Bushy aster (*Aster dumosus*)

Tests of the soils supporting the above species in the pine barrens have shown them to be, practically throughout, of the high specific acidity of 300.

To explain the occurrence in this coastal area of plants showing elsewhere widely divergent preferences as to habitat, the author states that plants in List I. evidently required an abundance of available lime and other bases, either free or in the form of salts, but necessarily tolerant of high acidity. Those of List II demand high acidity, but must be torlerant of the presence of salts. Other plants which were not found on the coastal regions, but were indigenous to the neutral soil uplands and the pine barren area, apparently were not capable of withstanding the presence of salts in spite of a suitable degree of acidity.

The plants on the following list were observed on soil which when tested showed a low degree of acidity averaging a specific acidity of 3; the high content of the lime and other bases in the glacial material from which the soil is derived, evidently preventing the development of a higher degree of acidity:—

LIST III. *Plants of Rich Woods, Oak Island, Massachusetts*

Slender wild rye (*Elymus striatus*) *
Bottle-brush grass (*Hystrix patula*) (*Asperella Hystrix*)
Woolly sedge (*Carex lanuginosa*) *
Canada lily (*Lilium canadense*)
Trout lily (*Erythronium americanum*)
Bellwort (*Uvularia perfoliata*)
Showy orchid (*Orchis* [*Galeorchis*] *spectabilis*)
Blunt-leaf sandwort (*Arenaria* [*Moehringia*] *lateriflora*) *
Strong-scented meadow rue (*Thalictrum revolutum*) *
Red baneberry (*Actaea rubra*)
Shrubby bittersweet (*Celastrus scandens*) *
Hone wort (*Deringa canadensis*) (*Cryptotaenia canadensis*)
Sweet cicely (*Osmorrhiza* [*Washingtonia*] *longistylis*)
Fringed loosestrife (*Steironema ciliatum*)
Richweed (*Collinsonia canadensis*)
Figwort (*Scrophularia marilandica*)
Wood betony (*Pedicularis canadensis*)
Lopseed (*Phryma Leptostachya*)
Horse gentian (*Triosteum aurantiacum*)
White rattlesnake root (*Prenanthes* [*Nabalus*] *alba*)

The salt marsh mud proved, as usual, to have a specific alkalinity ranging from 30 (wet portions) to as low as 3 (hummocks). Between the woods and the salt marsh is a strip of damp ground a few metres in width supporting a flora quite unlike that of either woods or salt marsh; instead, the species were found to be those elsewhere characteristic of peat bogs, sandy or peaty margins of ponds, sandy barrens, etc:—

LIST IV.

Bog club-moss (*Lycopodium inundatum*) *
Switch grass (*Panicum virgatum*) * (in damp sand)
Blue-joint grass (*Calamagrostis canadensis*) (also in swamps)
Green spike-rush (sedge) (*Eleocharis olivaceae* *) (also in wet bogs)

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* Found also in the coastal area of New Jersey.

Three-square sedge (*Scirpus americanus*) *
Twig-sedge (*Cladium* [*Mariscus*] *mariscoides*) *
Canada rush (*Juncus canadensis*) *
Turks-cap lily (*Lilium superbum*)
Grass-pink orchid (*Limodorum tuberosum*) (*Calopogon pulchellus*) *
Pink bearded orchid (*Pogonia ophioglossioides*) *
Cross-leaf milkwort (*Polygala cruciata*)
Inkberry (*Ilex glabra*) *
Sweet pepper-bush (*Clethra alnifolia*) *
Privet andromeda (*Xolisma ligustrina*) (*Lyonia ligustrina*) (also in dry barrens)
Highbush blueberry (*Vaccinium corymbosum*) * (also in dry barrens)
American cranberry (*Vaccinium* [*Oxycoccus*] *macrocarpon*) *
Buckbean (*Menyanthes trifoliata*) (also in wet bogs)
Large gerardia (*Agalinis* (*Gerardia*) *purpurea*) *
Small gerardia (*Agalinis* (*Gerardia*) *paupercula*) (also in dryish sands)
Small bedstraw (*Galium trifidum*) (also in wet bogs).

The intervening strips of damp ground would naturally be inferred to be approximately neutral in reaction, but the vegetation is characteristic of admittedly highly acid soil, and the soil in this strip when tested, showed a specific acidity of 300, similar to that of the average sandy barren and peat bog. The reason for the development of this acidity at the border of the salt marsh may be attributed to the fact that sea water is drawn up by capillarity into the soil around the edge of the woods, its bases are absorped by the clay and humus, and acids are set free. That the occurrence of the plants in list 4 on soils of this high acidity is a matter of preference and not a mere matter of tolerance is clearly indicated by the fact that the majority of these plants are not known to grow in any habitat with a much lower degree of acidity than this.

The author's information should go far towards destroying the fallacy that the important, if not the only soil factors influencing plant distribution, are physical properties of the soil.

368 – **Location and Lie of the Phosphate Beds in Western Morocco** (1).— SAVORNIN, T., in the *Comptes rendus de l'Academie des Sciences*, Vol. CLXXII No. 4, pp. 229. Paris, Jan., 24, 1921.

Morocco has rich sedimentary eocene phosphate beds (white or grey sand) in the regions of Beni-Meskine Plateau or El Borouj-Oued Zem which continues towards Kasba Tadla. On the south their width varies from 1-50 km. and from east to west more than 120 km. The reserves are estimated at over 3-4 thousand million metric tons.

The author has observed other beds in the hydrographic basins of Oum er Rebia, Bou Chane, Tensift, and Oued Kçob.

1) THE AHMAR-REHAMMA BASIN. — The middle valley of Oum er Rebia divides the great plateau of Beni-Meskine from that of Selam-R'ereba-Oulad Delim, where the eocene overlays the primary and archean

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* Found also in the coastal area of New Jersey.

(1) See *R.* Jan. 1921, No. 19. (*Ed.*)

formations (1). The surfaces of the two plateaux are formed of the same lutetian limestones at Thersitées resting on the marly, siliceous and phosphatic strata which constitute the suessonian layer.

The number, value and extent of the phosphate deposits are known in the plateau north of Oum er Rebia but no prospecting has been carried out in the South. The author thinks that they exist, always of a sandy nature, as is shown by the debris around Arab wells. Silico-phosphatic, blocks are also spread over the soil on the southern slopes of Bou Chane and are frequently intercalated near the upper parts of certain layers at El Borouj-Oued Zem.

This basin extends latitudinally for more than 80 km to the east of Lake Zima, the broadest part measuring 30 km. About half (to the south-east) is probably buried under the hydrostatic level.

The maps made by BRIVES and GENTIL show that the lower eocene lies to the west of Lake Zima bordering on the hinterland plain of Safi. This can only mean the sinking of a flexure at the edge of the cretaceous escarpment because it forms part of a great outcrop in which the cenomanian gypsum rises as far as the douar of Biassa. This indication shows the existence of the suessonian under a portion of the neogene littoral.

2) SUPERFICIAL RESIDUES AT CHILCHAOUA. — This name is given to the eocene outcrops mentioned by BRIVES and LEMOINE along the Modgador-Marrakech road (Auk el Djemel, Raïat, Tilda), excluding those mapped along the Chichaoua oued and which the author has not seen.

The limestones at Thersitées here form narrow table lands like the desert " Gours. " The suessonian is spread around them in an irregular arc whose contours are very broken up. The largest dimension from east to west is 18 km and 10 km from north to south.

Prospecting has shown the existence at Tilda of useful beds but less rich than those at El Borouj. The road cutting at Raïat shows a workable bed interrupted by a fault.

No phosphate beds are known there.

3) THE SYNCLINAL OF THE MESKAIA. — This outcrop, easily studied at Khemis des Meskala, is compressed in the limestone which forms a series of undulations to the north of Mtouga. It is very eliptical, and measures 25 km in length by 5 km in width facing South.

A curious form of suessonian in which the lutetian covering is lacking forms the detached plateau of Zned, whose area does not exceed 300 hectares.

The prospecting of these two beds, separated by a crevasse 1 km. in width (road from Tleta el Hanchen to Khemis Meskala) is still to be made. The author knows, however, of the existence of phosphate beds there.

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(1) It rests on the upper cretaceous layer in the east towards Gada des Selam Rieraba (near the Rehammas), and on the middle cretaceous in the west, near Zaquia Sidi b Madhi er Rhouati (near the Ahmar) (*Author*)

4) EVIDENCE OF THE IBIL. — A minute trace of calcareous fluid exists on the Southern flank of the Ibil (Djebel Ibil is marked Dar Kaïd Mtougui on the 1 : 20 000 map).

This is the point of a synclinal relieving the precedent towards the east and nearly all buried under the alluvial plain of Oulas Jenmouna. The visible part is some hectares in extent, and traces of silico-phosphatic layers can be recognised in it.

5) THE IMI N'TANOUT BASIN. -- The author has fixed the stratigraphical position of an outcrop south of the synclinal, at Imi n'Tanout. This fold finishes in the west 5 km. from Zaouia Sidi Abd el Moumen. It stretches to the east along the borders of the Atlas Mountains as far as Amismiz.

The eastern end, according to BRIVES and GENTIL, lies at the foot of the Kik platau. Almost the whole basin, nearly 15-20 km. in breadth, is hidden under quaternary and oligocene alluvia.

The situation is unsatisfactory from an industrial point of view because the hydrologic basin, probably artesian, floods the phosphates. The prospecting of Imi n'Tanout and Kahira gave encouraging results, but the above remark takes away all practical value from them .

6) TANAOUT OR HAOUZ BASIN. — The author indicates this basin on the evidence of the geological maps. It is separated from that of Imi n'Tanout by a great eocretacious and paleozoic saddle connecting the platean of Kik to that of Tameslouht.

The tectonic disposition is probably the same as in the preceeding basin, and phosphate may be found there.

There only remains to be found indications connecting with it, towards the north east with the synclinal of Kasba Tadla, by Demnat and oued Abid. In short, the great tablelands of Beni-Meskine and Oulad Delim are by far the most important from an industrial point of view. Compared with the immense wealth lying here, the Chichaoua residues have but a theoretical interest; they show the continuity of the tablelands as far as Djebilet and the return to the little or not transgressive position of the suessonian. The other basins give us information as to the formation of the Atlas mountains, the clearness of their folds and their filling up by the aquitanian continent formations shows the importance of the Pyrenean orogenic movement on the edges of the great and middle Atlas Mountains.

As regards the suessonian transgression noted by the author to the south of Ben Guerir and as far as Lake Zima, it shows eustatic oscillations unaccompanied by folding. This regime characterizes all the paleogeographic evolution of Western Morocco during the secondary periods.

369 – **Field Experiments with Nitrogenous Fertilisers.** — I. LIPMAN, J. G , and BLAIR, A. W., Field Experiments on the Availability of Nitrogenous Fertilisers, 1908-1917, in *Soil Science*, Vol. IX, No. 5, pp. 371-392, tables 10, bibliogr., of 3 works, Baltimore M. D., May 1920. — II. THORNE, C. E., Carriers of Nitrogen in Fertilisers, *Ibid.*, Vol. IX, No. 6, pp. 487-494, tables 8. June 1920.

I. — A report of a 5 year period of work started in order to study the relative availability of different nitrogenous materials and loss of nitrogen under a 5 year rotation of maize, oats, wheat and 2-years timothy. Twenty $^1/_{20}$ acre plots were limed and 20 others were left unlimed. Certain plots in each section received no fertiliser, others one element only, others a combination of phosphorous and potassium, and others nitrogen, phosphorous and potassium. All nitrogen treated plots received annually 640 lb. acid phosphate and 320 lb. muriate of potash per acre. Farmyard manure was applied to certain plots at the rate of 16 tons per acre annually and one plot in each section received this + 320 lb, nitrate of soda. Fertilisers and manures were applied annually at about seeding time, except with the autumn sown crops, when ¼ of the mineral nitrogenous fertiliser is applied at the time of seeding and $^3/_4$ as a top dressing the following spring.

The average yield of dry matter and the percentage of nitrogen recovered was greater with nitrogenous mineral materials than with organic materials. Nitrate of soda gave the largest yield and the highest % of nitrogen recovered on the unlimed section and sulphate of ammonia the highest on the limed section. The 4 mineral materials gave for the 5 year period an average recovery of 29.4 % nitrogen (unlimed) and 33.3 % (limed). Of the 3 commercial organic materials, dried fish gave the highest yields of dry matter and % nitrogen recovered on unlimed and dried blood the highest on limed.

Average yield of dry matter mineral and organic nitrogenous materials compared.

		Unlimed section		Limed section	
		1908-1912	1913-1917	1908-1912	1913-1913
		lb.	lb.	lb.	lb.
Average 4 mineral materials:					
(Calcium nitrate, ammonium, sulphate, calcium cyanamide, sodium nitrate).	Grain . .	6 002.5	3 631.2	6 379 6	4 211.2
	Straw, etc .	14 686.4	11 715.0	15 534.6	13 280.0
Average 3 organic materials:					
(Dried blood, dried fish, concentrated tankage).	Grain . . .	5 602 9	3 406 7	6 074.5	4 061.7
	Straw, etc. .	13 503.4	10 812.0	12.596.8	11 253.3

The average annual yield for all the unlimed plots was 28.3 lb. per acre and for all the limed plots 31.1 lb. per acre. In each section the maize and wheat drew most heavily on the nitrogen, for example, on the limed sections, the maize removed on an average 57.9 lb. per acre, which is almost as much as contained in 400 lb. of nitrate of soda. The average total amount removed by crops in general on the limed and unlimed plots was 170.2 and 149.6 lb. per acre respectively.

Analyses of samples of soil from plots of the 2 sections showed that the limed plots lost during 10 years, nearly 250 lb. more of nitrogen than the unlimed plots. The authors suggest that in this case and with no leguminous crops in the rotation to furnish additional organic matter, oxidation may continue with moderate speed without the stimulating effect of lime. The well limed plots furnish a favorable medium for the organisms that destroy organic matter, and this accounts for the heavier loss of nitrogen.

The supply of nitrogen and carbon was best maintained on those plots which received farmyard manure and the said manure + sodium nitrate. The carbon content of these plots has even been increased over the carbon content of the original soil. On the general average, there was less nitrogen and carbon in the soil of limed than of the unlimed section.

The author considers that these results indicate the difficulty of maintaining the nitrogen supply of soil at a high level under continuous cropping with non leguminous crops, even when commercial fertilisers are supplied in generous amounts.

II. — Report of a 5 year cereal rotation conducted in duplicate at the Ohio Agricultural experiment Station. Nitrogen was applied comparatively in the form of nitrate of soda, linseed oilmeal, dried blood, sulphate of ammonia and in tankage. The same comparison was repeated with a potato, wheat, clover rotation. In every case the plots received equal quantities of phosphate, potash and nitrogen. At the experiment station Germantown a 3 year rotation experiment with tobacco, wheat and clover has been in progress since 1903, with plots treated on similar comparison lines to the above.

Results confirm those obtained in the experiments described in Part I With only 2 exceptions in the 40 comparisons, nitrate of soda produced the largest yield. With the tobacco, wheat, clover rotation, the results were similar except on limed land where the yields from sulphate of ammonia slightly exceeded those from nitrate of soda.

370 - **Contribution to the Study of the Fertilising Action of Sulphur.** — NICOLAS, G., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 1, pp. 85-86. Paris, Jan. 3, 1921.

Investigation has shown that flowers of sulphur when added to the soil in suitable amounts, acts as a fertiliser and increases the crop yield. Sulphur, an element indispensable to plant life, performs at least a double action. It supplies the plant by bacterial oxidation in the soil with sulphuric acid which is directly assimilable, and this sulphuric acid especially in non-calcareous soils facilitates the absorbtion of certain mineral elements (potash, iron, oxide, alumina and even manganese); in addition it also facilitates the work of nitrifying and ammonifying bacteria and thus places larger quantities of nitrogen at the disposal of the plant.

It has even been thought that sulphur favours the development of the root nodules of leguminous plants. With a view to obtaining exact information on this point the author experimented on this subject in 1918 in Algiers and in 1920 at the Jardin des Plantes at Nancy, with peas

Phaseolus, Lathyrus Ochrus and *Lupinus albus* grown in pots to which sulphur was added in amounts corresponding to 100, 200 and 300 kg. per hectare. No very definite result was obtained possibly on account of the high nitrogen-content of the substratum (garden soil). The experiments, however, showed that sulphur in suitable amounts helps the carbonaceous nutrition of the plants. The appended table shows the distribution of starch in the vegetative organs of the haricot and pea, exception being made of the leaves that were already dried up when gathered.

In amounts suited to each species (200 kg. per hectare for *Phaseolus* and 300 kg. for pea), sulphur favours the formation of starch and consequently photosynthesis. MAZÉ and DEMOLON have shown that sulphur is necessary for the development of chlorophyll, that its absence causes chlorosis and that it increases the formation of chlorophyll. Because of this action on the green pigment, the decomposition of carbon dioxide in the air is activated, the carbon is fixed in larger quantities stored in the form of starch; research on the gaseous exchanges in assimilation would probably confirm this assertion.

	Stem (Base)	Stem	Root (Base)
		Phaseolus.	
Without sulphur	Starch very rare in secondary woody parenchyma and at the periphery of the medulla.	Starch very rare in secondary woody parenchyma but abundant at periphery of medulla.	Starch rare in secondary wood parenchyna and at periphery of medulla.
100 kg of S.	Id	Id	Id.
200 kg. of S	Starch abundant in secondary w. parench and per. of pith.	Starch very abundant in s w. p., abundant in per. of pith	Starch abundant in s. w. p. and in per. of pith
300 gk of S	Starch very rare in s. w p , rare in per of pith.	Starch very rare in s w p , abundant in per. of pith	Starch rare in s. w p and in per. of pith.
		Peas.	
Without sulphur	No starch.	—	No. Starch
100 kg of S.	Starch very rare in secondary liber	—	Id.
200 kg of S.	Id.	—	Id.
300 kg. of S.	Starch abundant in secondary liber and in pith Fairly abundant in s w. p.	—	Starch fairly abundant in the medullary rays of the secondary wood.

371 - **Botanical Exploration of French West Africa.** — CHEVALIER, A., *Exploration botanique de l'Afrique occidentale française.*, Vol. I. *Enumération des plantes récoltées, avec une carte botanique, agricole et forestière.* I Vol. 8 vo., XVI + 798 pages. Published by Paul Lechevalier, 12, Rue de Tournon, Paris, 1920 (*Author's communication*).

This work, which has just appeared, was in the press before the war. The map had already been published in Vol. XXVI, No. 4 of *Géographie.* (October 15, 1912).

It gives the limits of the 12 chief plant formations and clearly defines the 5 great zones (the Sahara desert, the Sahelian zone, the Sudanese zone the Guinea zone, and the great virgin forest). The area of dispersal of the 12 wild species of plants most useful to man is shown, as is also the situation of the large natural pastures, which offer a great future to stock-breeding. In the same way, the zone of the Niger flood is also marked, as the soil of this district, after preparation, is suited to irrigated crops.

The object of this work is to make known the vegetation of the regions eplored by the author, his former collaborators O. CAILLE, F. FLEURY and V. MARTRET, and also by his correspondents. CHEVALIER, being unable to explore Mauritania himself, made use, in his description of that country, of information collected by ARNAUD, Col. MOURET, Capt. RONGER, Lieut. G. SCHMIDT, Adjutant CHARLES, Dr. DUCELLIER, M. CHUDEAU, etc.

In the course of the 7 journeys he made in West Africa, between 1898 and 1912, the author collected in French West Africa alone no fewer than 17 000 herbarium specimens.

In Vol. I., he enumerates all the species collected, mentioning the localities and places where they were found. Sometimes he also adds information regarding the habit of the plant, the colour of the flowers, its properties and uses, and its native name. More detailed information upon these points as well as the descriptions of new or little-known species will, however, be found in the subsequent volumes.

CHEVALIER has indeed set himself the task of giving, for all the wild or cultivated species, the details of their dispersion, favourite habitat, biological characters, (periods of vegetation, flowering, fructification, etc.). He will also add the names by which they are known in the dialects of the different countries traversed by him, as well as remarks upon the properties and uses of the principal species.

The last volume will be devoted to the botanical geography of French West Africa.

372 - **Composition of Tuber, Skins and Sprouts of Three Varieties of Potatoes** (1).— COOK F. C., (Physiological Chemist Miscellaneous Disivion, Bureau of Chemistry, U. S. Dept. of Agriculture) in *Journal of Agricultural Research*, Vol. XX, No. 8, pp. 623-635, tables 3, bibliogr. of 13 works. Washington D. C., Jan., 15, 1921.

The composition of the potato varies with the soil and with the fertiliser used, as well as with other environmental and climatic conditions. Since the sprouts depend for their growth on the tubers, the author considers that the composition of the tubers may influence that of the sprouts to no small extent,. The object of the investigation under consideration was therefore to determine, if possible, whether any changes in the composition of sprouts took place after the use of copper sprays employed to control *Phytophthora infestans* or late blight of potato, just as copper sprays apparently influence the composition of tubers. It was also believed that the use of these sprays might influence the time of sprouting, that is, increase or decrease the rest period compared with that of unsprayed tubers.

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(1) On Rate of assimilation of food from soil by the potato plant and the relative proportion of each of the principal elements contained in the plants. See *R.*, April, 1918, No. 415 (*Ed*)

Samples of Rural New Yorker (No. 12), Green Mountain (No. 15), and Irish Cobbler (No 9) tubers from Maine, taken from vigorous and healthy plants, and also Green Mountain tubers (Nos 3 and 6) from Connecticut, taken from portions of the plots which stayed green the longest, were used for these tests. All the tubers were kept in the dark at an average temperature of 70°*F* from 4 to 8 months. The sprouts which developed on the Rural New Yorker Tubers were short and thick and on the others, comparatively long and branching.

Water extracts of the sprouts, skins and tubers were prepared and the following determinations made: 1) soluble nitrogen, employing 25 cc; 2) soluble phosphoric acid, 50 cc; 3) ammoniacal nitrogen, 5 cc; 4) separation of nitrogenous compounds 100 cc. Copper was determined in certain of the samples by the colorimetric method, using potassium ferrocyanide and standard solutions of copper sulphate.

The analytical data of these 3 Bordeaux sprayed potatoes showed little variation in composition, the age of the sprout apparently influencing the composition more than the variety. Data for Green Mountain sprouts, skins and tubers indicated that the spray did not change the rate of growth or the composition of the sprouts. The percentage distribution of the nitrogenous substances showed the sprouts to contain more protein and less diamino and other basic nitrogen (less than 10 % of the total nitrogen) than the skins and tubers. The younger tubers showed a higher water soluble nitrogen content than the older tubers. The amount of free. ammonia in the young sprouts was constant. More ammonia was found in the skins than in the tubers or sprouts. All samples tested showed copper, the sprouts containing somewhat more than the tubers or skin.

The percentage distribution of nitrogen, phosphoric acid and ash, in sprouts, skins and tubers depends on the relation weight of sprouts and tubers. The action of the sprouts was selective. The solids of the sprouts contained 4 % nitrogen whilst both the others contained less than 2 %.

The sprouts remained fresh, and continued to grow as long as any water was available in the tubers. The sprouts of the Irish Cobbler tubers constituted 17 % of the total weight of the sprouts and tubers at the time the latter were exhausted, while the Green Mountain sprouts under the same conditions, constituted 5.5 % of the total weight. The author suggests that the higher percentage in the first mentioned case is due to increased concentration or activity of the growth promoting agent.

A comparaison between sprayed and unsprayed tubers has shown that there is almost without exception a higher content of solids and nitrogen in the sprayed than in the unsprayed tubers.

373 - **The Proteins of Oats.** — BROCQ-ROUSSEU (Military Laboratory of Veterinary Research), in the *Recueil de médecine vétérinaire*, Vol. XCVIII, No. 2, pp. 44-53. Paris, January 30, 1921.

The author reviews the various works on the proteins of oats, especially the articles written by OSBORNE and his collaborators, and draws the conclusion that the only well-defined proteins found in oats are *avenaline*, a globulin extracted by salt solutions, and obtained in a crystalline condition, and a *prolamine* soluble in alcohol, and belonging to the same group as the gliadin of wheat. The author describes the methods he used for the preparation of these two proteins.

374 - **The Presence of Quinic acid in the Leaves of Certain Conifers.** — TANRET, G., in the *Comptes Rendus de l'Academie des Sciences*, Vol CLXXII, No. 4, pp. 234-236. Paris, January 24, 1921.

Quinic acid, originally discovered in cinchona by HOFMANN in 1790, has since that date chiefly been found in the family of the Rubiaceae, in various species of cinchona and remijia, and in the coffee-plant, and the bedstraw (*Galium*) of our pastures. The acid also occurs in the leaves of Ericaceae such as the whortleberry (*Vaccinium Vitis Idoea*), bilberry (var. *Myrtillus*) and other génera of Vacciniaceae, and has also been discovered in the leaves of tobacco, beetroot, and black currant.

The author has also found it in the leaves of some Abietineae viz., the cedar (*Cedrus Libani*; 5 gm. per kg. dried at 100°C); and the larch (*Larix europaea*; 3.5 to 5 gm. per kg. of leaves). Negative results have been obtained from the ivy and juniper.

375 - **The Injurious Effect of Dead Leaves Upon Germination.** — LUMIÈRE, A., in the *Comptes rendus de l'Académie des Sciences*, Vol CLXXII, No. 4. pp 232-234. Paris, January 24, 1921.

In seeking to account for seasonal rhythm, and for the re-awakening of the soil, both being phenomena independent of variations in temperature, the author previously (1) brought forward the hypothesis, that the soluble products present in the dead leaves and remains of annual plants, as well as those resulting from their fermentation, might perhaps play some part in these periodic phenomena.

To test this theory, the author first soaked, for 12 hours in 2 litres of water, lots containing 500 gm. each of the débris of dead plants; he then used the leaves of chestnuts, plane-trees, and of various fruit trees that had been collected as soon as they had fallen. He found that these solutions possessed very definite reducing properties, and apparently contained phenolic bodies. They completely prevented any seeds from germinating.

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(1) See *R.* Jan. 1921, No 11. (*Ed.*)

It was necessary to soak the leaves and other plant remains repeatedly before the water used ceased to exert any influence upon germination.

Under natural conditions, the fallen leaves and plant débris undergo progressive disintegration, and finally turn into humus. The author thought it would be worth while to study the effect of the products formed during the first stages of decomposition.

To this end, he left these plant remains to ferment of their own accord in the open air, under natural conditions, and found that the first changes were brought about by micro-organisms, of which the most important is a bacillus of the *Coli* species. As the fermentation process progresses, the medium becomes acid, assumes a darker colour, and emits a strong aromatic odour; at the end of three months, the extracted liquid is brownish-red, and very difficult to filter. As soon as a certain amount has passed through the filter, it becomes cloudy through absorbing the oxygen of the air, the surface becomes covered with an iridescent film, and if the filtering process is repeated the same results are produced, as a result of the formation of insoluble oxidation products.

This solution possesses reducing properties similar to those belonging to the water in which the leaves were soaked immediately after they had fallen, and it has also the same inhibitory effect upon the germination of seeds.

The authors' explanation of the awakening of the soil seems to be confirmed by these first results.

It is well-known that germination is characterised by very intense oxidation processes; in the absence of oxygen, it cannot take place,. At the time when annual plants die, and the trees shed their leaves, the rain dissolves the soluble, reducing bodies contained in this organic matter, and impregnates the soil with substances that absorb the oxygen, thus depriving the seeds of this element, which is absolutely necessary for their germination.

The same processes may continue for a short time at the beginning of the decomposition of the plant remains.

After the leaves fall, the soil will therefore remain sterile until such a time as the atmospheric oxygen that has penetrated into the soil, either directly, or dissolved in the rain water, shall have completely oxidised the reducing matters it contained.

This fact explains the great importance of ploughing operation, which bring to the surface the layers of soil that are full of sterilising agents, and thus destroy the paralysing effect of the latter.

It further accounts for the awakening of the soil in the first days of spring as soon as the higher temperature can hasten the completion of these reacsions, thus bringing to its termination the cycle that should be completed at this season of the year.

The author intends to continue his experments, not only for the purpose of contributing to the accurate knowledge of plant biology, but also with a view to discovering some means of restoring to the soil, early in the spring, the fertility which it loses temporarily during the winter through the agency of the reducing substances of which he has demonstraed the origin.

376 - **Note on the Inheritance of Rust Resistance in Oats.** — GARBER, R. J., in *Journal of the American Society of Agronomy*, Vol. 13, No. 1 pp. 41-43, figs 1, Washington D. C, Jan. 1921.

Report on selection and hybridisation experiments carried out with a view to obtaining rust resistant varieties of oats.

During the summer of 1918, crosses were made between a selection of White Russian oats (*Avena sativa orientalis*) resistant to stem rust (*Puccinia graminis avenae*) and a selection from two high yielding varieties, Minota and Victory (*Avena sativa*), but both very susceptible to rust.

The summer of 1919 proved to be favourable to the development of stem rust and the American varieties were badly attacked, whilst the white Russian variety suffered very little.

The F_2 plants showed sharp segregation and were placed in 2 classes : resistant and susceptible.

The analyses taken as a whole gave the follwing results in F_2:

Minota × White Russian, 104 resistant, 36 susceptible.

White Russian × Victory, 31 resistant, 9 susceptible.

The ratio is therefore 3 :1, indicating that the resistance depends on a single hereditary factor and apparently behaves as a dominant character in these crosses.

377 - **Inheritance of Resistance to Anthracnose, Mosaic Disease and Root Rot of Beans (*Phaseolus vulgaris*) in the Plant Breeding Department, Cornell University, New York, U.S.** — Mc. ROSTIE, G. P, in *Journal of the American Society of Agronomy*, Vol. 13, No., 1, pp. 15-32, bibliogr., of 13 works. Washington, D C., Jan., 1921.

Results of several years observations on the mode of inheritance of the common bean (*Phaseolus vulgaris*) of the factors concerned in the production of resistance to three common bean diseases of New York: anthracnose (*Colletotrichum Lindemuthianum*), mosaic disease and root rot (*Fusarium Martii phaseoli*).

Although the question of inheritance of resistance to disease has, to a large extent, attracted the attention of scientists, and considerable efforts have been made to fix and stabilise this character by hybridisation, up till now the literature on the subject is decidedly limited.

BIFFEN found that resistance to yellow rust (*Puccinia glumarum* Eriks and Henn) in his cross between Rivet, a slightly susceptible wheat, and Red King, extremely susceptible, behaved as a recessive ; all the F_1 plants and approximately 75 % of the F_2 plants having been susceptible.

NILSSON-EHLE arrived at similar conclusions.

VAVILOV in crosses between Persian wheat *Triticum vulgare* var. *fuliginosum* Al. (immune to mildew *Erysiphe graminis* D. C.) and varieties of common wheats susceptible to this disease, secured F_1 hybrids which were immune to mildew.

STUCKEY in breeding varieties of tomatoes resistant to blossom-end rot, found that resistance was transmitted as a dominant character.

TISDALE, studying the inheritance of flax wilt in crosses between resistant and susceptible flax varieties obtained a great variety of results grading all the way from F_1 generations that were wholly resistant to others that were very susceptible. He attempts to explain his results on the basis of multiple factors, claiming that under normal conditions *two* or *three* factors in the homozygous condition would be enough to show apparent resistance. However, under condition exceptionally favorable for infection, only those plants which had factors concerned in the homozygous condition would show resistance. The gradation in the F_1 results might, therefore, be explained on the bases of change of conditions and the number of factors involved.

BURCKHOLDER in crosses between Well's Red Kidney, a type of bean resistant to both α and β strains of *Colletotrichum Lindemuthianum* (Sacc. and Magn) Bri, and Cav., and the White Marrow, a type resistant only to the α strain, but susceptible to the β strain; out of a total of 473 plants tested gave 362 which proved resistant, and 111 susceptible to disease. These numbers show almost an exact 3 : 1 ratio and indicate a single factor a difference between resistant and susceptible plants with respect to the β strain of the anthracnose fungus *Colletotrichum Lindemuthianum* concerned in the cross.

The author has obtained similar results in connection with the inheritance of resistance of *Phaseolus vulgaris* to the 3 diseases, anthracnose, mosaic disease and root rot.

ANTHRACNOSE. — Two strains α and β of this fungus *C. Lindemuthianum* are reported. By crossing Well's Red Kidney (resistant to both strains) with Michigan Robust (susceptible α strains, but resistant to β) of 1970 F_2 plants which were inoculated 1471, showed resistance and 499 susceptibility, which gives an approximate 3 : 1 ratio with resistance dominant.

Another cross was made between selection B (White Marrow var.) (homozygous and resistant to both α and β as the resistant parent), and vars. German Wax and Wardwells' Wax (susceptible). Also additional crosses were made between Michigan Robust (susceptible to α and resistant to β) and White Marrow (*vice versa*).

In all these crosses, unlike the cases heretofore reported when there was apparently only one single factor difference there is on the contrary, where both α and β strains are concerned, a 2-factor difference and a 9 : 7 ratio in F_2 is obtained. This is demonstrated by the data given by the author in the following table (reduced).

MOSAIC DISEASE. — The real cause has not yet been traced. In the hybridisation experiments made up till now, the variety Robust obtained originally from the Michigan Agricultural Experiment Station was chosen as the resistant parent, and the susceptible parent used was almost exclusively the Flat Marrow.

Pedigree Nº	Parentage of hybrids	Resistant	Susceptible	Total
5485	German Wax × Selection B	32	27	59
5478	Wardwell's Wax × Selection B	62	43	105
5486	*Idem*	14	20	34
5557	*Idem*	26	21	47
5558	*Idem*	82	69	151
5483	Robust × White Marrow	216	158	374
5484	*Idem*	90	54	144
	Totals of plants . .	**522**	**392**	**914**

Inoculation was carried out by rubbing vigorously the primary leaves of the healthy plants with affected leaves from plants already attacked, or by using seed produced by infected plants. A large percentage of this seed produced mosaic offspring. Insects contribute to a considerable extent to the dissemination of this disease.

Inspection was made of the F_1, F_2 and F_3 hybrids.

Genetic Behaviour in F_1. — In spite of the numerous possible errors which accompany artificial inoculation tests, a large number of susceptible plants were observed, which indicates that in this case, resistance is a recessive.

Results in F_2 *and* F_3. — A large deviation lies between the two extremes, and it is, therefore, difficult to classify according to the divers categories. In F_2 taking the total number of plants tested as 5272, the number of susceptible plants was 2982 compared with 2290 resistant, (ratio 9 :7). The results obtained for F_3 were analogous. In view of the ratio reported, it may be assumed that 2 factors are concerned in producing susceptibility or resistance to disease. Plants homozygous for both dominant factors might be expected to show a greater degree of susceptibility than plants heterozygous for both these factors. In the same way, plants homozygous for the recessive allelomorphs would be expected to show an equal resistance to that of the resistant parent and superior resistance to that of plants homozygous for one recessive allelomorph or heterozygous.

This explains the variation and intermediate gradations which so often occur in succeeding generations to F_1, and which render so difficult the distinction between each category.

ROOT ROT. — This disease is caused by *Fusarium Martii phaseoli* Burck. According to experiments already made the resistant parent was the variety, Flat Marrow, which, however, unfortunately matures too late, and the susceptible parent was Michigan Robust Pea. which matures somewhat earlier. The ,method adopted was to make a spore suspension of the casual organism in water and dip the beans before planting. The genetic behaviour of F_1, F_2 and F_3 was notified.

F_1 : — The majority of plants showed no resistance, which indicated that susceptibility is at least partially dominant over resistance.

F_2 and F_3 :— In classifying the plants in this case, a certain arbitrary standard must be set up. In the present case, the author divides the plants into 2 groups: 1) those which vary from medium to marked infection; 2) those which vary from medium to normal condition of healthy roots. The following table shows the inoculation results for F_2..

Pedigree of Hybrids	Condition of roots	
	Medium to severe infection	Medium to no infection
Flat Marrow × Robust	4	3
Flat Marrow × Manchurian Pea	3	3
Idem		4
Flat Marrow × Manchurian Branberry		4
Flat Marrow × Marrow		6
Flat Marrow × B. 39	12	10
Flat Marrow × B. 20	9	6
Pea (Dye) × B. 126	2	1
Marrow Flat Marrow	6	5
Flat Marrow × Marrow	8	5
Flat Marrow × Robust	12	9
Idem	13	12
Idem	19	11
Wells' Red Kidney × Flat Marrow	9	7
Flat Marrow × Robust		5
Robust × Flat Marrow	5	5
Idem	6	3
Idem	16	7
Robust × Pea (Dye)		11
Idem	30	14
Pea (Dye) × B. 126	13	10
Robust × Flat Marrow	14	18
Flat Marrow × Robust	10	10
Pea (Dye) × Marrow	11	7
Flat Marrow × B. 39	13	11
Numbers observed	**247**	**187**
Numbers estimated on ratio 9:7	**244.1**	**189.9**

Taken collectively, the results approximate to a 9:7 ratio which indicates the presence of 2 genetical factors with susceptibility dominant. Results with F_3 confirm this hypothesis.

PRACTICAL RESULTS. — The investigations here reported had for their objects, the purpose of studying the method of inheritance of disease resistance and of obtaining varieties of beans resistant to the 3 diseases concerned. From the families reported as homozygous resistant to anthracnose, a number of white seeded resistant strains have been isolated, some of which give promise of becoming good commercial types. One of the parents involved in this cross was also resistant to mosaic and some of the selected types show resistance to both mosaic and anthracnose.

The majority of the crosses made in connection with the studies of the inheritance of susceptibility to both root rot and mosaic were reciprocal crosses between the rot resistant variety Flat Marrow and the mosaic resistant to *Colletotrichum Lindemuthianum* (Sacc. and Magn.) Bri. and Cav. β strain, which is the strain most commonly found in New York State. A few hundred F_2 plants have been selected and isolated from this cross which do not show signs of either root rot or mosaic and which should probably be resistant also to the β strain of anthracnose. Only high yielding plants which mature early should be selected so that the resistant types obtained possess a commercial value.

Some F_2 plants were also selected from reciprocal crosses between Flat marrow and White Marrow; the first is resistant to root rot and to anthracnose β while the second is resistant to the α strain and is at least tolerant to mosaic. It is hoped, therefore, to obtain from a combination of parent characters, the desired progeny resistant to the 3 diseases in question.

378 - **Inheritance of Certain Characters in the Cowpea (*Vigna Sinensis*).** — HARLAND, S. C., in *Journal of Genetics*, Vol. 10. No. 3, pp. 193-205. London, Oct. 1920.

The experiments here described are concerned with the following characters: anthocyanin in stem and leafstalk, colour of seed coat pattern, pod, and flower of *Vigna sinensis*. The author attaches special attention to the colour of the seed coat pattern, which is regulated by 4 existing factors: B = black, N = buff, M = maroon, and R = red. The colour may be due to the following combinations:

Black	**BNMR**
»	**BNmR**
»	**BnmR**
»	**BnMR**
Brown	**bNMR**
Buff	**bNmR**
Maroon	**bnMR**
Red	**bnmR**
White	due to absence of R.

The New Era is the best known and most highly valued variety of *Vigna sinensis* amongst farmers as a forage crop. The seeds are thickly and uniformly dotted with a dark blue anthocyanin pigment on a buff back ground. The pattern is always associated with purple coloration of the tip of the young bed, calyx and peduncle. The pattern taken as a whole is due a factor E which has no visible effect except in the absence of R.

The factor B (black) and E (New Era) both produce as one of their effects anthocyanin coloration of the tip of the young pod, calyx and peduncle, but B produces a more intense coloration than E.

Thus the cross black (BNR) by buff (bNR) will give in F_2 the ratio 3 black to 1 buff, while the cross New Era (ENR) by buff (eNR) will give in F_2 3 New Era to 1 buff. If the factors Band E are inherited independently, a cross between black (BNR) and New Era (ENR) should produce the double recessive buff (be), once in 16 times in F_2, thus:

9 B E N R	3 B e N R	3b E N R	1 b e N R
?	black	New Era	buff

But the actual results obtained by crossing black by New Era showed in F_2 a segregation into 644 black and 197 New Era out of 841 plants. and no buff. The double recessive be does not occur.

These facts may be explained by the phenomenon of repulsion of factors B and E (b and e respectively) during gamete formation. The hybrid F_1 black × New Era (Bb Ee NN) being heterozygotic relatively to the 2 factors, should form 4 sorts of gametes: BE, Be, bE and be, which gives rise in F_2 to 16 different combinations, as shown in Table I.

TABLE I. — *Combinations of* F_2

	BE	Be	bE	be
BE	BBEE	BBEe	BeEENN	BbBe
Be	BBcE	BBeeNN	BbeENN	Bbee
bE	bBEE	bBEeNN	bbEENN	bbEe
be	bBeE	bB eeNN	bbeENN	bbee

One of these 16 combinations (bb ee NN) gives a buff double recessive. On the other hand, being given the existance of a repulsion betxeen B and F_1 the gametes possessing characters B and E and b and E simultaneously cannot develop further, and only the combinations as shown in Table II are formed.

The occurrence of a buff double recessive is therefore excluded and only the individuals black and New Era, ratio 3:1 are obtained.

The evidence is not strong enough to establish the degree of incompatibility between B and E; the authors estimated the repulsion on a basis probably higher than 1:15.

In certain varieties of *Vigna sinensis* the pod is green in the early stages, but shortly before maturity it develops a deep purplish red colour as it develops anthocyanin pigment throughout the pods, calyx and peduncle. It is assumed that one main factor P is responsible for this purple coloration, which produces an effect analogous to that of B and E, but less intensity of colour than that due to B.

TABLE II. — *Combinations of* F_2.
in cases of repulsion of characters B *and* E.

	o	Be	bE	o
o	o	o	o	o
Be	o	BBee	BbeE	o
bE	o	bBEe	bbEE	o
o	o	o	o	o

The relation between B and P as already noted is analogous to that between B and E as regards repulsion between the 2 factors during gametic development; the gametes BP and bp are therefore much more rare than the heterozygotes, following the ratio 7 : 1.

379 - **Inheritance in *Ricinus Communis* L.** — HARLAND, S. C, (Imperial Department, of Agriculture West Indies), in *Journal of Genetics* Vol. 10, No. 3, pp. 207-218. London, Oct. 1920.

Studies on the mode of inheritance of certain characters in the castor oil plant, *Ricinus communis* L.:

(1) *Bloom.*
(2) *Spines* on the capsule.
(3) *Colour* of the vegetative parts.

1) *Bloom.* — Varieties of *Ricinus* are distinguished by the presence or absence of a waxy bloom (factor B). Presence and absence of bloom (Band b) behave as a pair of simple allelomorphic factors. The presence is partially dominant to its absence.

2) *Spines on the capsule.* — The presence and absence of spines on the capsule form another pair of allelomorphs (SANDS) with spininess partially predominant.

Colour. — Two independently inherited Mendelian factors are involved: M. the factor for mahogany and G the factor for green. The absence of the 2 factors (mg) gives a pale type of rose and tinged.

The factor G converts tinged into green (mG = green) and mahogany into rose (MG = rose).

The 4 types resulting from the cross Mg × mb are:

9 MG	3 Mg	3 mG	1 mg
rose	mahogany	green	tinged.

Relation between the factors **S** (SPINES) *and* **B** (BLOOM). — The relation between these 2 factors has been studied in a cross between **Bs** and **bS** The F_2 results are given below:

Family	**BS**	**Bs**	**bS**	**bs**
1	17	0	4	2
2	29	11	9	7
3	31	14	6	5
4	25	10	6	3
5	40	15	10	3
6	78	18	20	4
7	44	14	16	7
8	52	19	18	3
9	48	14	13	4
10	33	20	11	2
11	13	7	6	2
12	39	15	4	5
13	18	16	12	4
14	25	7	8	2
Effective Totals	492	160	143	55
Theoretical Totals	489	163	163	54

From these results it may be concluded that **B** and **S** are independently inherited.

This is analogous in the case of **S** and **M**, **M** and **G** and perhaps also of **G** and **B**.

The relation of **G** and **B** was investigated in a back cross **Gg Bb** × **gb gb**: the following were the results:

Family	**GB**	**Gb**	**gB**	**gb**
1	10	6	2	12
2	6	2	4	7
3	1	1	1	0
4	3	4	5	3
5	14	8	9	9
6	3	1	4	1
7	3	1	0	3
8	7	5	5	2
9	1	5	2	5
10	15	7	13	11
11	1	2	2	2
12	1	5	3	0
13	1	3	4	3
14	9	12	8	17
15	16	17	12	12
Effective Totals	91	79	74	87
Theoretical Totals	83	83	83	83

It will be seen that **GB** and **gb** are in excess of **GB** and **gB**, and it would be unsafe to assume that **G** and **B** are linked. According to the data, the percentage of crossing over between G and B is 46.2, practically independent inheritance.

Relation between the factors **M** (*Mahogany*) and **B** (*Bloom*). — The factors **M** and **B** show repulsion in the cross **Mb** × **mB**.

380 - Study of the F_1 and F_2 of a Hybrid Resulting from a Natural Cross Between the White-Headed Cabbage and the Green Pinnate Cabbage.

— KRISTOFFERSON, B KARL, in *Sveriges Utsade foreningens Tidskrift*, Year XXXI, Part. 1, pp. 31-52, figs. 8, Malmo, 1921

This study of a natural hybrid between the white-headed cabbage and the green pinnate cabbage is part of a series of crossing experiments carried out with different varieties of cabbage during the last few years. The results, in brief, are as follows: —

(1) The hybrid is intermediate in character between its two parents, having a very loose head with an elongated axis, and partly curled leaves.

(2) The median vein of the leaf, as well as the lamina, of the individuals of the F_1 are of a dark violet-red colour quite distinct from that of the parents; the median vein of the white cabbage being green during the summer, and light-red towards autumn, while that of the green cabbage always remains green.

(3) In the F_2, three types of leaf-veining are found: — (1) dark-violet red veins; (2) light violet-red; (3) green, in the ratio of 9 : 3 : 4. The dark violet-red shade is thus due to the presence of 2 factors A and B. A by itself exercises no effect, whereas B can produce a light violet-red coloration in a white cabbage.

(4) As regards certain characters, the offspring in the 2nd generation show every gradation between the extreme or parental, types (continuous variation).

" Head production " is one of these characters. The following table gives the data relating to some of the hybrids, the individuals being divided into 6 classes. In the 1st class are placed all the individuals resembling the green pinnate cabbage, and showing no sign of head formaton. In the 6th class are placed the individuals with compact, well developed head like that of the white-headed cabbage. In classes 2 to 5 are found the hybrids that are intermediate.

No. (year 1919)	Head development						Percentage of individuals with well-devoloped head
	class 1	class 2	class 3	class 4	class 5	class 6	
133	1	19	60	9	6	0	0.00%
134	0	5	11	66	22	11	9.57
135	15	55	202	76	12	2	0.55
136	6	91	379	400	68	14	1.46
137	1	101	836	816	89	14	0.75
138	0	22	430	730	52	13	1.04
139	5	38	754	977	60	14	0.84
Totals . .	**28**	**331**	**2672**	**3074**	**309**	**68**	*Average* **1,08 %**

Similar differences occurred with regard to the following characters: —

(*a*) Hairiness of leaves.

(*b*) Subdivision of lamina.

(*c*) Leaf-form; this shows every gradation between the two extreme forms, viz., the ovoid, nearly round form of the white cabbage, and the narrow, pointed shape characterising the leaf of the green cabbage.

(*d*) Waxy covering of the leaves.

(*e*) Height of plant.

(*f*) Capacity for keeping during the winter.

(*g*) Tendency to run to seed.

(5) With regard to variations in the disposal and distribution of chlorophyll, the following cases were observed: —

(*a*) Two sectorial chimeras, one with a white, the other with a yellow sector.

(*b*) Seedings white and yellow at the time of germination.

(*c*) An area free from chlorophyll on either side of the central vein.

(6) Transgressions (the appearance of characters more strongly marked than those of the parents): —

(*a*) Dark violet-red colour of median vein.

(*b*) Light violet-red of leaf.

(*c*) Leaves still more curly and pinnate than those of the green cabbage.

(*d*) Leaves still more vesicular than those of the green cabbage (resembling those of the savoy).

(*e*) Formation of small bulbs in the axils of the leaves.

(*f*) Plants covered with so much glaucous bloom, that it appears like a grey patina.

(*g*) Height of plant.

(*h*) Tendency to run to seed.

(*i*) Susceptibility to low temperatures.

(7) In the F_2, many forms made their appearance, some of which are similar to the following commercial varities: — Red cabbage, " Wersing" (Savoy cabbage), " Schlitzer" white cabbage, Brussels cabbage, different types of ornamental cabbages.

(8) In the F_2, there were also found plants whose leaves much resembled the turnip-cabbage, or with leaves and inflorescences much like those of broccoli and cauliflowers.

381 - **A Graft Chimara in the Apple in the United States.** — STOUT A. B. (New York Botanical Garden), in *The Journal of Heredity*, Vol. XI, No 5, pp. 233-237. figs. 1. Washington D. C., May-June 1920.

In an orchard in the vicinity of Geneva N. Y. is an apple tree planted there in 1862 which bears two types of fruit; some typical of the variety King (about 20 %) and others nearly identical with the fruits Rockbury Russet.

The occurrence of two more or less distinct kinds of fruit on the same tree may be due to: 1) vegetative variation or bud sporting; 2) top grafting;

3) a chimera : two kinds of cells belonging to stock and scion become associated together in the same branches.

The two first hypotheses are not considered probable, and the proof that the chimeral effect is produced is evidenced by the fact that certain fruits have been found with a segment that is King while the rest are Russet.

It is very probable that the chimera from a scion of King grafted on the root of a seedling of Russet, has grown from a bud that arose on the line of contact between scion and stock. Lateral branches arising from the sector of king are pure for King ; those arising from the part that is Russet are pure for Russet ; those that happen to arise from the lines of contact continue to be sectoral chimeras.

382 - **Maize in Brazil.** — SAMPAIO, S., in *Lavoura e Criação*, Year 6, No. 1, pp. 10-17. Rio de Janeiro, January, 1921.

Three-quarters of the world's maize production is grown in the United States. During the period 1913-1918, the average annual maize production of that country amounted to 69 836 214 tons. Amongst the other countries, the first place is occupied by Brazil, where there are, in round figures, 3 million hectares under maize, some 51 million quintals being produced there annually. Argentina is a very close second to Brazil, and has perhaps outstripped it of recent years. According to the data supplied by the Director of the Brazilian Office of Commercial Statistics, the quantities of maize exported from Brazil and imported by it from 1917 to 1920, were as follows :

Year	Exports		Imports	
	Amount kg.	Value in *paper milreis* (1)	Amount kg.	Value in *paper milreis*
1917	24 054 425	3 926 677	187 142	40 854
1918	14 275 450	3 535 971	1 299 354	166 782
1919	3 475 400	879 072	5 262 426	849 207
1920	(2) 3 207 855	690 436	(3) 2 754 061	437 852

(1) one *paper milreis* = 2s. 2d. at par.

(2) 11 months. According to the data furnished by the *Bulletin of Agricultural and Commercial Statistics*, International Institute of Agriculture, the amount exported for the whole year was 44 260 quintals.

(3) 9 months.

Given, on the one hand, the enormous and constantly increasing consumption of maize in Brazil, and on the other ,the difficulty of competing with Argentine maize which is produced at less cost, owing to the very extensive areas under the crop, and the greater transport facilities possessed by the latter country, it cannot be expected that Brazilian maize will be an important article of export in the near future. It can, however, become of the greatest value, if used to feed the swine which are exported in the form of canned or frozen pork or, still better, as lard.

The average cost of producing 1 hectolitre of maize grain in Brazil is 3.4 milreis; the sale price is 9.7 *milreis*, with a profit of 185 %.

The author mentions the many ways in which maize is used as human food and the countless preparations made from this cereal in the United States by the cook, baker, and pastry cook. He advises that greater use should be made of maize in Brazil, with a view to reducing the consumption of wheat, which is nearly all imported. In 1919, wheat and wheat flour were imported into Brazil to the value of a little over 208 million *milreis*.

383 - **Green Manures and Paddy Cultivation in Ceylon** (1). — MOLEGODE, W., in *The Tropical Agriculturist* Vol LXI, No. 1, pp. 3-6, Peradeniya, Ceylon, Jan. 1921.

The use of green leaves and twigs as manure for paddy fields is now extensively practised and is being recognised as the most economical, safest and best manure to use.

It has now been ascertained that to get a fair increase, at least 2000 lb. should be applied per acre. The first lot should be spread over the fields after the first "*Bin neguma*", or the ploughing, and at this time such leaves and twigs as would take a longer time to decompose should be applied. At the "*Dehiya*" or second ploughing, the leaves and twigs should be ploughed in, and afterwards the second lot should be spread over the ploughed, field. Sufficiently long interval will have to lapse between this and the final ploughing for the leaves and twigs to decompose and mix into the mud.

It is suggested that with green manures and phosphates should be applied at the rate of 1 to 1 ½ cwt per acre, at the final ploughing period.

The following list of trees and plants from which leaves and twigs are commonly in use is given:

Karande (*Pongamia glabra*). Kekuna (*Canarium zeylanicum*). Dadap (*Erythrina lithosperma*). Keppitiya (*Croton lacciferus*). Wild sunflower, Nattasuriya or Titta Sinh (*Tritonia diversifolia*). Adathoda, (*Adathoda vasica*). Wild indigo, Pila Sinh (*Tephrosia purpurea*). Sunn hemp (*Crotolaria juncea*). Bodi (*Psoralea corylifolia*). Hanapatta (*Furcraea gigantea*). Suriya (*Thespesia populnea*) Etdemata (*Gmelina arborea*). Totilla, (*Oroxylum indicum*). Kaduru (*Cerbera Odollam*) and Tarana (*Webera corymbosa*).

Very satisfactory results have been obtained in unproving paddy soils, resulting in large yields. For example — a field of approximately 2 acres was treated with leaves of kekuna (*Canarium zeylanicum*) and karande (*Pongamia glabra*). The yield thus obtained was 104 bus. compared with previous yields of 80 bus. The quantity of green manure employed was about 1500 lb. per acre. Other cases are also quoted showing equally advantageous results.

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(1) In the same publication of this *Journal* is an additional article on the subject of Green manuring, reproduced from the *Indian Scientific Agriculturist*, Vol. I, No. 12, dealing with the green manure crops grown in various parts of the country with success on wet lands, and ploughed into the soil at the time of puddling. Amongst these are quoted pulse crops such as: — horse gram (*Dolichas biflorus* Linn), green gram (*Phaseolus Mungo*), field gram (*Cicer arietinum*) etc.: — and Sunn hemp (*Crotolaria juncea*), " Boga medeloa " (*Tephrosia candida*), indigo and Daincha. Wild Indigo is recommended for heavy soils, being very drought resistant and with a deep root system. It also thrives well on well-drained land containing coarse sand particles. Hints are given concerning the application of lime in conjunction with green manuring in general.

384 – **Experiments with Varieties of Food Crops in Mauritius.** — *Bulletin No.* 19 *General Series Department of Agriculture, Mauritius*, pp 2-8, Port Louis, 1920.

The crops experimented with have included Sweet potatoes (*Ipomaea Batatas*), Manioc (*Manihot utilissima*), Pistacio (*Arachis hypogea*), Yams (*Dioscorea sativa*), Rice (*Oryza sativa*), and also Soy Beans (*Glycine hispida*), Cow Peas, (*Vigna Catjang*) and Guinea Corn (*Sorghum vulgare*). These varieties included various types known and cultivated locally, together with forms introduced from other countries. The results of the experiments with the last 3 crops are not as yet sufficiently complete to warrant publication. The other details given however afford reliable information concerning imported varieties of food crops, some of which are of superior yielding power to the local varieties.

385 – **Millets for Fodder on Sugar Estates.** — BARBER C. A., in *The International Sugar Journal*, Vol. XXII, Nos 261, 263 and 264, pp 493-494, pp. 613-616, pp 684-686. pl. 3. London, Sept; Nov; Dec. 1920.

A review of the principal millet crops with a view to drawing attention to the importance of improving fodder supplies on sugar estates, and of placing the facts before planters in sugar growing countries where these crops have hitherto been little known. The crops described are as follows: —

	Water %	Proteid %	Ol or Fat %	Carbo hydrate %	Crude Fibre%	Ash %	Nutritive Ratio
				Grain:			
Sorghum (*Andropogon Sorghum*) .	10.7	9.71	3 69	72.38	1.54	2.05	1 : 8.3
Ragi (*Eleusine coracana*)	11 29	9.44	4.93	60.13	6 56	7.65	1 : 7.5
Varagu (*Paspalum serobiculatum*).	8.84	8.04	4.57	65.20	7.39	5.95	1 : 9.5
Kambu (*Pennisetum typhoideum*) .	8.77	9.52	5.33	73.52	0.78	2.08	1 : 9.0
Paddy	12.55	6.35	2.14	65.29	7.84	5.83	1 : 11.0
Wheat	13 33	9.74	1.76	70.18	2.10	2.98	1 : 7.7
				Straw:			
Sorghum (*Andropogon Sorghum*) .	8 70	2.10	1.50	39 67	39.77	8.24	—
Ragi *Eleusine coracana*)	14.16	1.94	0.62	49 11	28.93	5 24	—
Varagu(*Paspalum serobiculatum*) .	8.71	1.97	2.51	47 92	28.84	10.05	1 : 26.8
Kambu (*Pennisetum typhoidum*). .	7.07	1.94	1.33	43 99	37.63	8.04	1 : 23.5
Paddy	11.04	2 70	1.02	40.84	29.23	15.17	—
Wheat	8.71	3 01	0.98	37 93	35.69	13.93	1 : 13 0

Andropogon sorghum (Sorghum) (1) ; *Pennisetum typhoideum* (Bulrush millet) (2); *Setaria italica* (Italian millet) ; (2) *Eleusine corocana* (Ragi) etc.

The foregoing analyses of the grain and straw of millets, paddy and wheat is given (*).

* Reproduced from "Notebook of Agricultural Facts and Figures" by R. C. WOOD.

386 - **"Fructa de lobo" (*Solanum grandiflorum* var. *pulverulentum*) and "Capoeira branca" (*S. bullatum* and *S. cernum*) Forage Solanaceae of Brazil.** — DR SILVEIRA. (Director de Agricultura de Estado de Minas Geraes), in *Characas e Quintaes*, Vol. XXIII, No. 1, pp. 17-19, figs. 2. São Paulo, January 15, 1921.

The author mentions these three wild, arborescent, Brazilian Solanaceae as forming a good stock feed. The foliage of "Fructa de lobo" (*Solanum grandiflorum* Ruiz and Pavon, var. *pulverulentum*) is readily eaten by cattle, in spite of the fact that the leaves, like the trunk, are covered with hooked spines. The fruit is much liked both by cattle and pigs. This plant will grow even on the most sterile ground. A farmer of Caeté who planted it for a pig feed obtained excellent results.

The name "capocina branca" is popularly given to two very nearly-related species, *S. cernum* Vell., and *S. bullatum* Vell. The latter and very probably also the former, is much appreciated by cattle, horses, mules and rabbits. The following percentages were obtained by analyses made at the Chemical Laboratory of the Minas Geraes:

Chemical composition of Solanum bullatum and Solanum grandiflorum.

	S. bullatum Per cent.	*S. grandiflorum* Per cent.
Water	10.47	11.31
Ash	9.98	4.83
Protein	23.92	19.47
Fats	3.16	3.16
Crude fibre	26.78	35.85
Nitrogen-free extracts	25.69	25.38

These plants therefore have leaves richer in protein than those of forage Leguminosae.

As the fruits of *S. bullatum* are greedily eaten by birds of every kind, even before they are ripe, it is difficult to obtain any seeds of this plant.

387 - **Bahia Grass (*Paspalum notatum*) in Florida.** — *Science and Industry* Vol. 2, No. 11, pp. 644-645. Melbourne, November, 1920.

Bahia Grass (*Paspalum notatum*) was first planted at the Florida Agricultural experiment Station in May 1913. The original plot is still growing and from the first gave promise of much value.

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(1) See *R* Sept. 1917, No. 811. (*Ed.*)
(2) See *R* April 1919, No 459. (*Ed.*)

A further experiment was begun in March 1915, and in September the same year, cattle were pastured on the plot in question both winter and summer from then onwards During the past 4 years the grass has been subject to heavy pasturing. Notwithstanding this fact, it has continued to grow and has made a complete sod over a space now 10 to 12 ft wide. In addition to this, a large number of individual plants have sprung up near by, indicating that the seed has been scattered by the cattle, birds, or wind.

The method here employed gives information on two important points, namely, the ability of the grass to spread and make a good sod while being pastured, and its palatability to cattle. It seems best adapted to a rather moist soil, but has been grown on rather dry sand soil with fairly satisfactory results. It is not likely, however, to be of any value when planted on dry sandy ridges or on land subject to overflow of water. A temperature of 34 to 26° F will nearly always kill all green growth of this grass; although the roots are apparently not injured by light frost.

388 – **Cotton Cultivation in Egypt** (1). — DUDGEON G C., I — The Maintenance of the Quality of Egyptian Cotton, in *Bulletin of the Imperial Institute*, Vol. XVI, No. 2. pp. 160-170. London, April-June, 1918. — II. The Pink Boll Worm and the Cotton Crop of Egypt. *Ibid.*, Vol. X I, No. 3, pp. 362-370. July-Sept. 1918. — III. The Extension of Cotton Cultivation in Egypt. *Ibid.*, Vol, XVII, No. 2, pp. 195-204. April-June, 1910. IV. Cotton Research Board of Egypt. *Ibid.*, Vol. XVIII, No. 1, pp. 117-119 Jan-March, 1920. — V. Agricultural Legislation in Egypt, relating to the Protection of Cotton Crops, *Ibid.*, Vol. XVIII, No. 2, April-June, 1920. — VI. The Egyptian Cotton Problem. LEAKE H. M., in *Agricultural Journal of India*, Vol. XV, Pts. 5-6, pp 485-501, 595-615, and Vol. XVI, Pt. 1. pp. 7-18. Calcutta, 1920 and 1921.

I. II. III. — The total area of cultivated land in Lower Egypt during the 10 years ending in 1914, remained fairly constant, but the proportionate area under cotton increased by nearly 6 % reaching 45.4 % of the total cultivated area of that region. It appears that cotton comes into the crop rotation, in a large part of the country, twice in three years, and that the old triennial rotation has to a large extent disappeared. In Upper Egypt, the fluctuation of the area under cotton is always to some extent affected by the behaviour of the Nile flood, as a certain proportion of each year's crop is grown in the basin lands, which have not yet been placed under perennial irrigation by canals But, even taking this into account, there was a steady increase in the cotton area from 1908-1909 and from 1913-1914, amounting to 5.2 %, for the 6 years.

Excluding the lake area, there are in round figures, 5 600 000 Egyptian acres already cultivated, watered either by summer canal supply or by flood, and there still remain 1 250 000 acres capable of becoming productive of general crops in the future, when properly irrigated (2). Conditions are more favourable in Lower than in Upper Egypt but taking the normal cotton area of Egypt as a whole at 1 716 000 Egyptian acres, it would be possible to cultivate annually upon the same system of rotation as at present in vogue, an additional 1 005 000 acres. To ascertain the actual maximum area, the lake areas must be taken into account, and this when properly drained would probably be suitable in the first place for a rotation of cotton and rice, with intermediate clover. On this rotation, 50 % would be under cotton annually, and would give an additional 312 000 acres to the previous total, making a total of 3 033 000 acres annually capable of yielding cotton.

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(1) See *R.* July 1913, No. 801 and *R.* August 1915, pp. 1017-1023. (*Ed.*)

(2) See *R.* Dec. 1913, No. 1323. (*Ed.*)

With regard to production, assuming that the new acres be brought under cultivation, it is calculated that a total yield of 11 240 000 quantars (1) per annum should be obtained The climatic and cultural conditions found in Egypt afford the country unique advantages with respect to the production of cotton possessing combined qualities of fineness, strength and length, in comparison with other countries. Experiments have been conducted in India and Arizona in order to establish similar varieties there, but up to the present it has been found that Egyptian kinds grown in these new localities are less prolific and more susceptible to disease and rapid deterioration in quality that is the case in Egypt. Attention is, however, drawn to the fact that the successful results obtained by selection and a consequent isolation of three pure kinds of cotton in America should be regarded as a warning of what may happen if steps are not taken to maintain purity of the existing commercial varieties in Egypt itself (2). The period of life of these last mentioned varieties is not long owing to the fact that the characteristic qualities, which constitute its value, are usually rapidly broken down by cross-fertilisation in the field or by careless mixture of seed in the ginneries. The assumption of the mutational origin of these varieties (3) is supported by what has been found to occur in experimental breeding from Egyptian seed in Arizona (4).

With respect to the kinds of cotton which it is probable may be grown in the near future, it is expected, although that the matter is still under dicussion, and nothing is yet definite, that the Sakellaridis cotton will occupy the attention of growers throughout the Delta for some years, and that there is very little likelihood of a return to the old types, Nubari, Assili and Afifi. Upper Egypt will continue to cultivate Ashmouni, which has been somewhat improved. The most important change in the cultural requirements is that, whereas up to less than 10 years ago, it was not uncommon to continue picking until December, most of the crop is now finished even in Lower Egypt, by the end of September.

This early maturing character has become of the first importance by reason of the ravages of the pink boll worm (*Gelechia gossypiella* Saunders). This pest destroyed practically all the seed of plants which matured late. The average loss, according to Dr. LEWIS GOUGH attributed hitherto to the pink boll pest was about $^1/_5$ the weight of seed + lint in every boll attacked,

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(1) 1 quantar = 99.049 lb. (*Ed.*)

(2) See *R.* December 1918, No. 1356. (*Ed.*)

(3) See *R.* May 1918, No. 520. (*Ed.*)

(4) See *R.* Feb. 1914, No. 116 (*Ed.*)

e. g. if 35 % of the bolls were attacked, the loss in weight of the crop was about 7 %. Hence the obvious advantage of cultivating early varieties.

The author emphasises the fact that the extreme area capable of being cultivated in cotton can only be attained as the result of a great deal of careful engineering and expenditure.

IV. V. — In view of the great importance of the cotton growing industry to the welfare and prosperity of Egypt, the Cotton Research Board was constituted in May, 1919 to " combine, co-ordinate and extend research of cotton ". On appointing this Board, the Ministry of Agriculture pointed out the economic importance of maintaining the valuable quality of Egyptian cotton, confirming the statements made by DUDGEON (Parts I, II and III).

Field experiments have already been undertaken in a number of different localities on 1) the effect of the subsoil water level on cotton, 2) reducing watering, 3) yielding power of 9 varieties, 4) spacing. The following programme of work has been drawn up:

1) *Botanical.* — The application of plant breeding methods to the purification of existing commercial varieties, and to the production of new and improved varieties. Cotton seed farms are being developed for the multiplication of pure seed strains. Special study will be made of cotton wilt and other fungoid diseases.

2) *Entomological.* — Study of the life history, distribution and control of *Oxycarenus hyalinipennis* (Cotton seedbug) and *Agrotis ypsilon* (cutworm), and a continued study of *Gelechia gossypiella.*

3) *Chemical.* — Observations in connection with manures and subsoil water, bacteriological aspects, investigations arising out of the composition of cotton seed and the changes which occur during storage.

4) *Physical.* — Field experiments and laboratory work on measurement of cotton fibre.

In the *Preliminary Report* (Cairo: Government Press, 1920), a diagram brings out the striking fact that from September 1919 to January 1920, it was more profitable to the grower to cultivate the shorter stapled cottons of the Upper Egypt class such as Ashmouni, than the longer stapled varieties, such as Sakellaridis and there is a danger that this action will extend greatly unless purchasers are prepared to offer a substantially higher price for the long stapled kinds.

Amongst the laws and ministerial orders relating to cotton, it is interesting to note that the irrigation of bersim is prohibited after May 10, or such date as may be fixed annually for certain districts. This law is established to prevent the propagation of cotton worm (1) by the growing of bersim which is another food plant of this pest. Also the roots of cotton, hemp and bamia (*Hibiscus esculentus*) are ordered to be plucked up or cut down, below soil level in such a way that they cannot give rise to any fresh growth, thus facilitating the destruction of bollworms (2).

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(1) Usually known by the name of *Alabama argillacea* Hubn.

(2) Usually known by the name of *Heliothis obsoleta* Fab.

VI. — A report of the recommendations made by Mr. H. M. LEAKE, Director of Agriculture in the United Provinces of India, with a view to the maintenance and improvement of the quality of Egyptian cotton, and the increase of yield. These include: 1) the maintenance of the purity of Sakellaridis; 2) the establishment of one or more types with the same intrinsic merits as Sakellaridis, but with an improved vegetative habit; 3) the maintenance of the present classes by a system of purification and the establishment of pure races; 4) the development of types agriculturally better suited to the environment, including the demarcation of type tracts 5) the development of a class of cotton superior in quality to the best Sakellaridis; 6) the division of the country into circles determined, as far as possible, by climatic considerations, and each with its experimental farm; 7) the establishment of a seed farm in each of the circles so defined; 8) the introduction of a system of licensing persons desirous of introduing new varieties. Such a system would enable steps to be readily taken to eliminate the cultivation of any new variety, if considered desirable, and to prevent the adulteration of existing varieties.

For the purpose of carrying the above recommendations into effect, the following further recommendations are made: 1) the division of the Ministry of Agriculture into a series of agricultural, botanical and commercial sections; 2) the establishment of a Ministerial Cotton Committee which should endeavour to co-ordinate practice with the result of these researches; 3) the establishment of an extra ministerial Cotton Board for providing co-ordination between the Ministry of Agriculture and the Physical Service and Irrigation Board, etc.

389 - **Fibre Studies of Philippine Dipterocarps.** — REYES L. G in *Journal of Forestry*, Vol XIX, No 2, pp. 97-104 Washington D C Feb 1921.

The Dipterocarpaceae is pre-eminently the most important timber producing family in the whole Indo-Malayan region an area including the greater part of India, Burma, Siam Cochin-China, the Malay Peninsula, Sumatra, Java, Borneo, the Philippines, and the Indo Malayan Archipelago as far south as New Guinea.

These dipterocarp woods lend themselves to multifarious uses. The soft lightcoloured woods (*Pentacme*, *Parashorea*, and *Shorea*) furnish a large percentage of the cheap construction timber in the Philippines. The red *Shoreas* such as *S. polysperma*, *S. negrosensis* etc. are used for high grade furniture and cabinet work, and the former has been employed successfully in the manufacture of aeroplane propellors. Various species, including *Hopea plagata*, *H. ovalifolia*, *Balanocarpus cagayensis*, *Isoptera borneenis* and *Vatica* spp., produce strong and durable structural timbers, and are extensively employed.

With the continued exploitation of Philippine forests and the increasing cost and scarcity of timber in the north temperate zone, new uses for dipterocarps are coming to the attention of the public The present fibre

Fibre Lengths and Widths of 33 Species of Philippine Dipterocarps.

Species	Length in mm			Width in mm.			Remarks
	Max.	Average	Min.	Max.	Average	Min.	
1. *Anisoptera Curtisii* Dyer	2.48	1.27	0.57	0.034	0.026	0.017	Vessels minute; wood comparatively hard.
2. *Anisoptera mindanaensis* Foxw.	2.67	1.93	1.29	0.040	0.028	0.017	Vessels large; wood medium hard.
3. *Anisoptera thurifera* (Blco.) Bl.	2.69	2.05	0.91	0.033	0.023	0.016	—
4. *Id.*	2.57	1.95	1.16	0.033	0.024	0.017	Vessels largest of the 3 specimens.
5. *Id.*	2.48	1.60	0.92	0.029	0.022	0.015	Vessels smallest of the 3 specimens.
6. *Balanocarpus cagayanensis* Foxw.	1.86	1.42	0.90	0.038	0.028	0.021	Sample from tree about 30 cm. in diameter
7. *Id.*	1.80	1.34	0.85	0.026	0.019	0.012	Sample from tree about 50 cm. in diameter (typical specimen).
8. *Dipterocarpus affinis* Brandis	2.34	1.77	0.67	0.034	0.023	0.017	Tree about 50 cm. in diameter, not typical of commercial product.
9. *Dipterocarpus cuneatus* Foxw.	2.39	1.58	0.74	0.034	0.027	0.017	Specimen typical of species.
10. *Dipterocarpus grandiflorus* Blco.	2.68	1.98	0.54	0.031	0.025	0.017	Speedy grower, soft wood, pores small.
11. *Id.*	2.30	1.66	0.83	0.031	0.026	0.017	Grain curly, wood dark coloured.
12. *Id.*	1.86	1.42	0.91	0.038	0.028	0.021	Grain crossed, otherwise typical sp.
13. *Dipterocarpus perturbinatus* Foxw.	2.43	1.80	0.81	0.034	0.026	0.017	Wood hard: vessels small.
14. *Dipterocarpus pilosus* Roxb.	2.33	1.73	0.92	0.034	0.026	0.019	Vessels almost similar to (15): wood softer.
15. *Id.*	2.54	1.51	0.96	0.031	0.027	0.021	—
16. *Dipterocarpus speciosus* Brandis	2.56	1.79	0.78	0.034	0 027	0.017	Specimen from immature tree.
17. *Dipterocarpus vernicifluus* Blco.	2.61	1.88	1.36	0.034	0.030	0.024	Vessels larger than (1): density practically the same.
18. *Id.*	2.65	1.71	0.78	0.031	0.023	0.017	
19. *Hopea acuminata* Merr.	1.97	1.38	0.65	0.024	0.019	0.012	Vessels larger: wood softer than (20): both samples typical of species.
20. *Id.*	1.52	1.21	0.74	0.024	0.018	0.012	
21. *Hopea mindanaensis* Foxw.	2.23	1.56	0.95	0.024	0.019	0.010	Sp. typical of the species.
22. *Hopea ovalifolia* Boerl.	1.91	1.48	0.79	0.024	0.018	0.014	—

Fibre Lengths and Widths of 33 Species of Philippine Dipterocarps.

Species	Length in mm.			Width in mm.			Remarks
	Max.	Average	Min.	Max.	Average	Min.	
23. *Hopea philippinensis* Dyer	1.91	1.36	0.91	0.021	0.017	0.012	Sp. typical of the species.
24. *Id.*	2.00	1.32	0.78	0.024	0.019	0.014	
25. *Hopea Pierrei* Hance	2.04	1.38	1.04	0.026	0.020	0.014	
26. *Id.*	1.78	1 36	0.74	0 024	0.019	0.014	
27. *Hopea plagata* Vidal	1 82	1.41	0.82	0.022	0.018	0.014	Wood softer than (28), which is typical of the species.
28. *Id.*	1.65	1.30	0.65	0.021	0·015	0.010	
29. *Parashorea Malaanonan* (Blco.) Merr	2.39	1.69	1.13	0.031	0.022	0.014	Typical specimen: vessels larger than those of (30).
30. *Id.*	1.87	1.39	0.87	0.029	0.021	0 012	
31. *Pentacme contorta* Merr. *and* Rolfe	2.18	1.58	1.04	0.039	0.029	0.022	Density and size of vessels practically the same as (32).
32. *Id.*	1.95	1.45	1.00	0.038	0·031	0.021	
33. *Id.*	1.84	1.33	0.74	0.038	0.023	0.016	Hardest of the 3 samples: growth somewhat abnormal.
34. *Pentacme mindanaensis* Foxw.	2.78	2.05	1.09	0.029	0.023	0.017	Typical specimens: vessels almost twice as large as (35); density practically identical.
35. *Id.*	2.52	1.75	1.17	0.038	0.027	0.019	
36. *Shorea balangeran* Dyer	2.21	1.54	0.82	0.024	0.018	0.012	Lighter and softer than in (37).
37. *Id.*	1.87	1.35	0.61	0.028	0.018	0.012	Sample typical of species.
38. *Shorea eximia* (Miq.) Scheff	2.39	1.78	1.26	0.034	0.024	0.017	Density of samples practically identical; vessels largest in (38), narrowest in (40); all samples typical.
39. *Id.*	2.26	1.64	1.13	0.034	0.028	0.024	
40. *Id.*	2.12	1.48	0 82	0.031	0.024	0.017	
41. *Shorea falcaferoides* Foxw	1.69	1.34	0.95	0.024	0.019	0.012	Typical hard *Shorea* sp.

Fibre Lengths and Widths of 33 Species of Philippine Dipterocarps.

Species	Lenght in mm.			Width in mm			Remarks
	Max.	Average	Min.	Max.	Average	Min.	
42. *Shorea Guiso* (Blco.) Blume	1.74	1.33	0.74	0.024	0.021	0.014	Specimens all typical of species.
43. *Id.*	1.95	1.45	0.69	0.024	0.019	0.014	
44. *Id.*	1.78	1.32	0.78	0.022	0.017	0.012	
45. *Shorea mindanaensis* Foxw.	1.95	1.36	0.87	0.029	0.021	0.016	Typical, sp.
46. *Shorea negrosensis* Foxw.	2.65	1.72	1.15	0.043	0.030	0.024	Both samples typical; (47) a faster growing species.
47. *Id.*	2.69	2.31	1.35	0.034	0.026	0.017	
48. *Shorea pallida* Foxw.	1.29	1.01	0.48	0.031	0.022	0.015	Pores small, wood light and soft; typical sp.
49. *Shorea palosapis* (Blco.) Merr.	2.00	1.48	0.87	0.038	0.025	0.021	Sp. (50) fast grower and has largest pores, otherwise all samples are typical.
50. *Id.*	2.08	1.61	0.91	0.039	0.029	0.021	
51. *Id.*	2.08	1.54	1.13	0.033	0.024	0.021	
52. *Shorea philippinensis* Dyer	1.56	1.05	0.65	0.031	0.022	0.016	Same as *S. pallida* (48); typical sp.
53. *Shorea polita* Vidal	1.52	1.16	0.82	0.028	0.028	0.017	
54. *Shorea polysperma* (Blco.) Merr.	2.26	1.56	0.91	0.034	0.024	0.017	(54) is densest of all 3 samples; abnormally hard; (55) and (56) are typical of species.
55. *Id.*	1.82	1.33	1.04	0.034	0.029	0.019	
56. *Id.*	2.13	1.51	1.04	0.029	0.023	0.016	
57. *Shorea Teysmanniana* Dyer	2.39	1.78	1.30	0.041	0.031	0.024	Density practically identical: (57) has larger pores.
58. *Id.*	2.34	1.69	1.17	0.039	0.027	0.017	
59. *Vatica Mangachapoi* Blco	1.61	1.22	0.69	0.024	0.020	0.014	Wood of (59) typical of species; harder than (60) pores $\frac{1}{2}$ as large.
60. *Id.*	1.83	1.42	0.78	0.024	0.020	0.014	

study was undertaken with the hope that it might contribute to the present knowledge of the suitability of the said dipterocarps for the manufacture of paper. In the selection of material, the author obtained authentic wood specimens from the Philippine Bureau of Forestry. After isolation of sufficient fibrous material, measurements were made of all fusiform non-septate fibres, which in the Dipterocarpaceae consist almost entirely of libriform fibres and tracheids; the latter are much pitted, shorter, proportionately wider, than the former but only constitute a small percentage of the fibrous material.

An examination of the tabulated measurements leads to a number of interesting deductions.. There is apparently little variation in the fibre length of the Dipterocarpaceae as a whole, but individual variations are both striking and significant Fibres seem to be longest in the softer wooded species such as *Anisoptera* spp. 1.76 mm, *Dipterocarpus* spp. 1.77 mm, *Shorea eximia* 1.76 mm, *S palosapis* 1.54 mm., and *S Teysmanniana*; 1.68 mm., compared with the harder woods such as *Hopea* spp. 1.40 mm, *Balanocarpus* 1.38 mm., *Vatica* spp. 1.43 mm., and hard *Shoreas* 1.46 mm. A similar variation also exists between different species of the same genus, and the author considers that other things being equal, the fibre length of dipterocarp wood varies indirectly to the density An interesting variation is found in woods of like density where pores distinctly vary in size The figures indicate that fibre lengths are directly proportional to the size of the pores. (compare Nos. 40, 39 and 38)

The soft, light coloured woods *Shorea eximia, Pentacme* spp. and *Parashorea Malaanonan* offer possibilities as a source of raw fibre in the manufacture of pulp and paper.

There seems no reason why these fibres should not be used advantageously either alone or mixed with bamboo, Manila hemp, maguéy (*Agave americana*), sisal and other long-fibred stock. At present. the coniferous stock *Populus tremuloides, P. deltoides* and *P. grandidentata* are the most important hardwood species in the United States from the standpoint of paper manufacture. The average fibre length of these species is 1.13 mm. as compared with the light coloured dipterocarps enumerated above, which average 1.60 mm.

390 - **The Coconut Palm in Brazil.** — DE MORAES, P., in *Brasil Indicador*, Year I, No. 1, p. 9, Rio de Janeiro, January 1921.

The coconut palm which is a native of America, grows almost wild along all the northern coast of Brazil, and is cultivated without difficulty throughout nearly the whole country. It begins to bear fruit before the age of 7 years. In the northern States of Brazil, where the coconuts are not gathered and used, a very important source of revenue is neglected, as is shown by the State of Parahyba, where the coconut palm is more or less cutivated, and in 1912, there were 115 900 trees in full bearing. If an average crop of 50 nuts per tree be assumed this amounts to 5 795 000 nuts per annum, which sold at 50 *reis* apiece (the minimum price) gives the sum of 289 750 *milreis* (1 *milreis* = 2s. 2d. at par).

This amount would be considerably increased if the value of the fibre, or coir, were added. According to RIDEAU 1000 coconuts furnish 836 kg. of coir, but even allowing for only 500 kg. of coir per 1000 nuts, this if it fetched no more than 150 *reis* per kg. would bring in 434 625 *milreis* (1 230 858 fr. at par). Thus, the State of Parahyba, by neglecting to gather the coconuts, loses altogether 724 375 *milreis* annually.

There are more than 100 million coconut palms whose nuts are never gathered in North Brazil. The author strongly urges that such a source of natural wealth should be turned to account.

391 - **Experiments in Sowing Seeds of *Cassia auriculata* in India.** — BENNETT H. C., in *The Indian Forester*. Vol. XLVII, No. 1, pp. 25-29, Allahabad, Jan. 1921.

An account of the experiments carried out at Golla, Anantapur, to determine the cheapest successful method of raising *Cassia auriculata* ("Tangedu"), a shrub which yields the most valuable tanning bark in India.

Six different methods of sowing, each on an area of not less than 5 acres, were tried namely:

1) Broadcast sowing on untouched soil.

2) Sowing in furrows about 2 ½ ft. apart and 4" to 6" deep.

3) Broadcast sowing followed by close ploughing in one direction.

4) Broadcast sowing followed by close ploughing first in one direction and then at right angles.

5) Close ploughing in one direction followed by hoeing with a 3-pronged fork (or "goru"), seeds sown in the furrows made by the prongs which are about 6 in apart and finally the whole gone over by a "guntakah" or iron plate drawn by 4 oxen in the same direction as the original ploughing was done to root out grass, turn up the soil, and cover the seeds.

6) Dibbling seeds under trees in soil turned up to a depth of about 6 in. by a spike or crow-bar.

Results. — The cheapest successful method was found to be No. 2. which cost 14 annas, per acre, and by it sufficient seedlings were obtained to stock any area with about 4 800 plants per acre. By method 3 at double the cost, about 27 times as many seedlings were obtained as by method 2, and were somewhat more advanced in growth at the end of a year. By method 5, about twice as many seedlings were got than by employing methods 3 and 4 and they were still more advanced in growth than those obtained by those too methods. The cost was 2-7 rupees per acre more than with method 3 and 8 annas 6 pies more than with method 4. Sowings under bushes and late sowings were failures.

The author suggests a further experiment, employing method 2, but making the furrows 10 ft. instead of 2 ½ ft. apart and thus tending to ensure sufficient regeneration and considerably less expense.

It is possible to grow "Tangedu" on land which can be ploughed, but which is too poor to yield profitable field crops.

392 – **The Cultivation and Preparation of Para Rubber in Burma** (1). — *Bulletin* No 7 *Department of Agriculture, Burma*, pp. 1-31 appendices 2, Burma, December 1920.

A general review of the soil, climate and methods of cultivation best suited to Para rubber.

Attention is drawn to the fact that in Burma the *Hevea* tree matures ready for tapping 5 to 6 years after planting. The stem is then usually 18 in. in girth at a height of 1 ½ ft. from the ground level. As it is the size of the tree rather than its age which determines its fitness for tapping and as, at any time in the age of the plantation, the area of bark up to a height of 3ft. from the ground, represents the capital of the planter, a considerable amount of care is necessary in the selection of the trees to be tapped. The point is emphasised that no tree should be marked up for tapping unless it be at least the girth indicated above. Tapping begins in September and is conducted without interruption, up to mid July. The flow of latex increases steadily from October to December, and then decreases up to February.

The usual method of tapping in Burma is known as the " one-third single cut " *i. e.* the tapping is conducted by means of a clean single cut and is always confined to only a third of the area of available bark. The second year's tapping is conducted over the second ⅓ of the bark surface adjacent to the first ⅓, but as the girth of the tree has naturally increased by that time, tapping begins at 2 ¼ ft. above ground instead of the prescribed 1 ½ ft. the first year. To complete this process 18 months is found necessary, and at the end of that time, the tapping is conducted on the remaining ⅓ of the bark surface, and this time at 3ft. above ground level. It thus takes 4 ½ years to tap once round the bole of the tree.

The following year the tapping is recommended at the 3ft. level and proceeds for 1 year over the depth of 1 ½ft. untapped bark which lies just above that treated at the first tapping, and is continued over the renewed bark that has gradually re-covered the surface first tapped. In succeeding years the afore-mentioned process is continued following the same method as before over the invariably re-covered surfaces.

The yield of rubber varies considerably, but the mean output is about 8lb. per tree per annum a yield which would probably be higher if the trees were planted further apart. The loss of soil fertility through scouring and leaching by heavy rain during the monsoon period is doubtless another contribution to the low yields, but it is recommended that by planting fewer trees to the acre *e. g.* 90 to 100, growing cover crops in the early rains, deferring weeding till the beginning of dry weather, disc harrowing regularly and carefully over a good mulch of green manure crop, and by more economical manipulation of the latex, an estate with trees 10 to 15 years old should yield at the rate of 350 to 400 lb. per acre per annum of dry rubber.

Lists of some suitable catch crops, cover crops and green manure crops are given as follows and details of general cultivation and treatment are also added.

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(1) See *R.* May, 1917 No. 440 and *R.* Jan., 1919., No. 1. (*Ed.*)

Permanent and Temporary Catchcrops for Rubber Estates

Name of crop		Seed per acre	Time of sowing	Time of harvesting	Probable yield per acre
Coffee (Liberian) "*Kapi*"	*Coffea liberica*	2000 cuttings	Cold weather	3 to 4 years after planting	1 to 8 lb per tree per year
Black Pepper "*Nga-yok Kaung*"	*Piper nigrum*	1000 cuttings	Rains	Dry weather 3 to 5 years after planting	1 to 7 lb dry fruit per vine per year
Cassava "*Pa-law pinanu*" "*Thin baw myouku*"	*Manihot utilissima*	3000 to 4000 cuttings	"	8 to 12 months from setting	2 to tons fresh roots per acre
Arrow root "*Ada lu*"	*Curcuma angustifolia*	20000 to 25000 sets per acre	"	6 to 9 months from setting	3000 to 8000 lb fresh roots per acre
Turmeric "*Sanwin*"	*Curcuma longa*	600 sets	"	6 to 8 months from setting	2000 to 4000 lb fresh roots per acre
Ginger "*Gin*"	*Zingiber officinale*	600 sets		"	"
Chillies "*Nga yok*"	*Capsicum annuum*	1 pyi*	July to August	December to January	100 to 200 viss* dry chillies per acre
Tobacco "*Tse*	*Nicotiana Tabacum*	1/4 pyi	April to May	December to April	200 to 250 viss of cured leaf + 30 baskets of stalks per acre
Groundnuts "*Mye-pe*	*Arachis hypogaea*	1/2 basket	May to June	December to January	20 to 40 baskets of whole nuts per acre
Lab-lab "*Pe gyi*"	*Dolichos Lablab*	"	September to October	March to April	12 to 20 baskets of seed per acre
Cow Pea "*Pe-lûn*	*Vigna Catiang*	12 lb	October to November	February to March	5 to 10 baskets
Green Gram, Black Gram "*Pe disein*," "*Mat pe*	*Phaseolus Mungo*	8 lb	"	"	200 to 400 lb. seed
Dâl "*Pe singon*"	*Cajanus indicus*	1 pyi	June to July	"	300 to 800 lb seed
Deccan Hemp "*Cyin bounggyi*"	*Hibiscus cannabinus*	1/2 basket	May to June	October to November	1000 to 2000 lb dry fibre per acre

* 1 pyi — 1 875 litre 1 viss = 3 6 lb

Cover or Green manure Crops for Rubber Estates. Sunn Hemp " Pikesan" (*Crotolaria juncea*) : Wild Hemp or " Taw pikesan " (*Crotolaria striata*): Indian Mallow, " Pauk-kwe " (*Abutilon indicum*) : Daincha " Pauk-pan " (*Sesbania aculeata*) " Ye-thagyi " (*S. aegyptiaca*) : Indigo, " Me " (*Indigofera tinctoria*) ; Wild Indigo " Me-yine " (*Indigofera* spp). ; *Tephrosia* spp ; Dadep or Coral Tree, Kon kathit, Ye-kathit " (*Erythrina indica* and *E. lithosperma*).

393 - **Pruning Experiments on Young Tea.** — *Quarterly Journal of Indian Tea Association Scientific Dept.* Pt II, 1920, and *The Tropical Agriculturist* Vol LV, No. 5, pp. 312-314. Peradeniya, Ceylon, Nov., 1920.

The results the of first and second years' pluckings after cutting down young tea at heights varying from the collar, up to 24 in. from the collar.

In the experiments made with Assam, Burma and China tea the percentage of deaths from collar pruning was 8 %, while from cutting to 2 in. above the collar, only 1 % of the bushes died. With still higher cutting the percentage of deaths was the same or slightly less. Except for the formation of a snag, the bushes cut at 4 in. gave equally as good bushes as those cut lower and averaged ½ maund per acre more than the 2 in. cut bushes cut in the 2 years test. This extra yield is, however, obtained at the cost of this dangerous snag which would certainly lead to trouble in districts where the white ants are prevalent. The 2 in. method is then, more satisfactory all things considered. It is true that the bushes thus formed are low, but it is probable that the yield can be greatly increased by leaving the bushes unpruned for the second year's plucking. The experiments under consideration were conducted under unusually unfavourable conditions, and the serious drought undoubtedly reduced the expected yield from the unpruned tea. Under normal circumstances the indigenous varieties would certainly have given more.

With the bushes which were not cut down, but " cut across " at varying heights, it appeared that the higher the bush was cut, the greater was the yield obtained These high-pruned bushes gave yields higher than would be obtained from the average clearance. The bushes were planted at 3 years old raised from seed, and then had 2 years growth unpruned and unplucked. At the time of cutting across, therefore, they were already a fair size. It should however be noted that with those cut across at 24 in, although giving a high yield, the crop was obtained entirely from the middle of the bush, and the outer part appeared very weak and was attacked by red rust (*Cephaleurus mycoidea*) (1), and brown blight (*Pestalozzia Hartigii*) and brow blight. It is very doubtful whether the present yield can be increased or even maintained from these high-cut bushes, whereas from those cut at 4 in. and below it is expected eventually to have well formed bushes, giving very high yields. By systematic cutting out of the centres of the bushes originally cut at 18 and 24 in. respectively, it seems possible that well formed bushes could also be made, but collar pruning at present is the only method advised for the said bushes.

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(1) See *R.* Feb. 1919, No. 266 (*Ed.*)

The cutting out of centres is, however recommended for 12 in. cut bushes, and this would secure the advantage of an early high yield, and a satisfactory frame.

394 - **Studies on Manuring Tobacco.** — I. WIMMER G., Ueber den jetzigen Stand unserer Kenntnisse und Erfahrungen in der Tabakdüngung, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 36, No. 10 pp. 166-168. Berlin, March 6, 1921. — II. VAN DIJK, J., Bemestings proeven bij de tabak op het veld in 1919, in *Medeelingen van het Deli Proefstation temedan Sumatra*, Series 2, No. 14, pp. 3-38, Year 1910.

I. — RESULTS OF THE EXPERIMENTS HITHERTO MADE IN MANURING TOBACCO. THE PRESENT STATE OF OUR KNOWLEDGE ON THE SUBJECT. — The basal manure used for tobacco crops is a dung poor in chlorides, preferably mixed (horse and cow dung).

Nitrate of sodium is little used, partly on account of the fact that tobacco treated with it often burns badly, probably because of the easily fusible deposit of alkali nitrates on the leaves, and because the leaves dry badly.

Sulphate of ammonium (50 to 100 kg. per hectare) or Norwegian calcium nitrate (in double the quantity) are employed ; the latter is very suitable, on account of its high lime content. The author found, as a result of many experiments, that ammonium nitrate makes the cigars burn quicker. Good results have been obtained from cyanamide, and much is hoped from synthetic urea. No conclusive proof has been obtained as to the effect of green manures on the burning properties of tobacco.

Potassic fertilisers are very necessary for tobacco. In Alsace, the fields where this crop is to be cultivated give in the autumn 400 kg. per hectare of potassium silicate (" martelline ") in addition to stable-manure. Sulphate of potassium is not used, as it is supposed to impart an astringent taste to the tobacco, which, however, has not been observed in Germany.

Experiments were made by KITZINGER for the purpose of determining the effect of manuring upon the quality of cigars, but all smokers are not of the same mind as to the results. Further, the results of tests as to efficacy of potassium carbonate are not in agreement.

A heavy application of stable-manure renders the use of a phosphatic fertiliser unnecessary. Where, however, such fertilisers are necessary, it is advisable to choose Peruvian guano and scories (1), and to avoid fertilisers containing a large amount of sulphates.

As the tobacco plant is calciphilous lime should be added to the soil, if the latter is deficient in calcium.

All these rules as to manuring are of secondary importance in comparison with the method of drying the tobacco during and after growth, especially from the point of view of its burning properties, the chief quality required in smoking tobacco.

II. — MANURING EXPERIMENTS CARRIED OUT IN TOBACCO FIELDS. — Experiments were made in Sumatra, in 1919, in order to observe the effect of manure upon leaf production and the vigour of the stem. The fertilisers used were superphosphates, ashes, ammonium sulphate and guano.

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(1) Similar results were obtained in Italy with scories. See AMPOLA and JOVINO : Il ferro nella combustibilità del tabacco, in *Gazzetta chimica Italiana*, Vol. I, p. 367, Rome, 1902 (*Ed.*)

The best results were obtained, as regards stem growth, by a fertiliser containing nitrogen, phosphoric anhydride and potassium in the proportions 1 : 3.6 : 1.

A fertiliser in the proportions 1 : 3.3 : 1, however, generally improved the combustibility of the fermented tobacco.

An excess of superphosphate hinders the growth of the plant (1)

395 – **Cultivation of Citrus Trees in Tunisia.** — GUILLOCHON, L. (Assistant of the Botanical Service of Tunisia), in *La Vie agricole et rurale*, Year 10, Vol. XVIII, No. 2, pp 28-30, 1 fig. Paris, January 8, 1921.

Unlike Algeria, Tunisia does not possess large areas suitable for planting with Aurantiaceae and such land as is well supplied with water, and where sufficient manure can be obtained, is already occupied by the orange-gardens belonging to the natives. Since 1912, however, several French landowners have bought orange-gardens from the natives (chiefly in the Nabeul district).

New plantations have also been made which are doing well, and it may be said that the cultivation of citrus trees is becoming a thriving industry in the Regency, oranges and mandarins being exported each year; the first consignments are dispatched usually about January 1.

During the war, large quantities of these fruits were supplied to the army.

According to the latest statistics (published in 1918), there are in Tunisia 61 000 orange-trees of which the production is estimated a 13 500 quintals.

According to the laws of July19, 1890, and of November 25, 1915, and to the decree promulgated under date of April 15, 1920, Tunisia is authorised to export to Marseilles free of all customs-duty, from August 2, 1920 to July 31, 1921, 5000 quintals of oranges, 10 000 quintals of mandarins, 5000 quintals of lemons, and 2000 quintals of citrons.

The principal citrus-fruit producing centres of Tunisia are. — In the neighbourhood of Tunis, Bardo, Manouba, Sokra, Ariana. In Cap Bon: Hammamet, Nabeul. In the Centre, near Sousse: Teboulba Mokenine. In the region of the oases: Gabès, Deggache, Tozeur; that is to say, in the coast districts, where great humidity of the atmosphere is combined with a minimum temperature that never falls below 4° — 5° C. and a mean temperature varying from 10°C to 16°C.

In the old, established gardens, oranges trees are the most plentiful, followed, in order of importance, by lemon and mandarin trees.

The new plantations consist of almost equal numbers of orange and mandarin trees, but in some cases the owners have added a few bergamots, citrons, and shaddocks.

Oranges do best on sandy clays or clay loams, and sometimes in default of these, a marly soil is selected, but pure clay is avoided, for the trees grow badly in it on account of its physical composition. Further, clay becomes very cold, as soon as the first autumn and winter rains fall, just when the fruits of the Aurantiaceae ripen. Under such conditions, the oranges should be grafted on *Citrus triptera*.

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(1) For manuring experiments at Havana, see *R.*, June 1920, No. 637. (*Ed.*)

Frequent irrigation is necessary in summer; the first manuring consists of 30 to 40 metric tons of night-soil or farm-yard, or stable-manure, per hectare.

Windbreaks are indispensable.

Some citrus-growers plant Seville orange stocks on which they subsequently graft; others transplant the stocks, when already grafted, from the nursery with the earth adhering to their roots, which are lifted almost entire. The former is the more economical method.

Intercalary crops of vegetables are planted between the trees. In winter, these consist of peas, French beans, and garden beans, in summer, melons are grown.

When the grafts have taken, they are more susceptible to the damp caused by the irrigation of the intercalary crops, and it appears best to discontinue them at this period; some cultivators, however avoid the difficulty by choosing plants that do not require much water.

In a garden where the lines of trees are 10 m. apart the intercalary crops may occupy a strip of 6 m., thus leaving clear 4 m. of soil around each tree.

Irrigation is practised from May to October; it may be reckoned, that 12 irrigations are indispensable during these months, 500 to 800 cubic metres of water per hectare being used each time. Each tree is irrigated separately, a basin being excavated round it.

The orange and mandarin trees are allowed to grow almost naturally, but they are pruned in such a way that their lowest branches are at 2.50 m. above the ground, which facilitates ploughing between the trees.

The varieties most commonly grown in Tunisia are, in order of commercial importance. — The Maltese orange with delicate flavour sweet, juicy slightly acid, a fine, almost round, fruit and a thin skin ; the Maltese blood-orange which is similar, but blood-red when quite ripe ; the meski orange, which has an insipid taste, a great favourite with the natives ; the Jaffa orange, with large oval fruit, rather thick skin, pulp delicious and melting in the mouth ; the various kinds known as navel oranges or with fruits inclosed and called " double oranges " ; Clementine, a hybrid between a Seville orange with narrow long leaves, the Granito variety, and a mandarin; it is a very good fruit of a fine red colour, and agreeable scent, ripens early (November to end of December), very juicy and sweet

The mandarins include the flat type, with fruits varying in size according to the manner in which the tree is cultivated, and the blood-mandarin, which has hitherto been of little commercial value.

The fruits that are picked up from the ground are sold on the spot at a low price, but those gathered from the tree are packed, the common varieties being put into cases or barrels ; the choice ones, of good colour and free from marks, are wiped, wrapped in tissue paper, and arranged in layers in deal cases, which are usually dispatched as postal packets.

Diseases and Pests. — Sooty mould (*Capnodium salicinum*) is very common, especially in the orange gardens belonging to the natives.

Septoria glaucescens, on the fruits of the mandarin orange-trees, has begun to be a rather troublesome disease in some orange-gardens.

Gummosis is prevented by grafting on Seville orange trees or other resistant stocks, as well as by leaving a heap of soil round the trunk to prevent the irrigation water coming into contact with the root-collar of the tree. In order to control this disease, the hard, cracked, bruised cortex should be removed as soon as the malady appears, the wounds should be disinfected with carbolic acid, and cauterised with a mixture containing tar.

The injurious insects are: The dipteron, *Ceratitis capitata*, and the scale insects *Chrysomphalus dictyospermi minor*, *Parlatoria zizyphi*, *P. pergandi* and, more rarely, *Aspidiotus aurantii*, and *Ceroplastes sinensis*. *Ceratitis capitata* is controlled by daily picking up and burning all the fallen, rotting fruits; whereas the scale-insects are best combated with lime-sulphur washes, or paraffin emulsion. If the trees are seriously attacked by these pests, the treatment should be repeated 2 or 3 times successively at intervals of 8 days

396 - A New Fruit "Masan" (*Zizyphus Jujuba*) Suitable to Certain Parts of Ceylon. — *The Tropical Agriculturist*, Vol. LV, No. 4, p 252. Peradeniya, Ceylon, October 1920

This thorny tree has been successfully grown up to a height of 800 ft. in India where the rainfall is scanty (25-35 in.), and the temperature 50 to 150 F.

Attention has been drawn by Prof. WOODROW to the fact that *Zizyphus Jujuba* has not been cultivated as much as it deserves. It is found growing in abundance in many parts of Ceylon in a wild state, but the fruits are small and of an inferior quality, and practically no attention has been paid to it except for the removal of thorny branches for fencing grass lands and palmyrah gardens. It is recommended now to use lands at present lying waste and unsuited for any other cultivation, and various tracts in the Western and Eastern Provinces.

The plants should be spaced at least 26 × 26 ft., and to raise the trees, seeds should be sown and when 2 years old budded with a superior variety as low down as practicable. No care and cultivation is required except to keep the land free of weeds and to turn up the soil lightly before and after the monsoon.

The best fruits are elliptical 2 in. in length and 1 in. thick. The trees start fruiting the first year, but a regular harvest can be relied upon the third year after budding, when one plant will produce from 82 to 150 lb. per season. The tree may be grown to perfection in scanty rainfall districts and is benefited by pruning in January or February.

397 - **The Timbers of the world** (1). — ELWES, H. G in the *Quarterly Journal of Forestry*, Vol XV, No. 1. pp. 63-67. London, Jan. 1921.

A publication (1) which has been much wanted by timber merchants, architects and users of wood generally for a great many years, is here reviewed by ELWES. Attention is drawn to the difficulty of acquiring the knowledge necessary to write on timbers both from the scientific and practical side owing to the number of tropical trees in the various continents as yet unidentified or described botanically. Especial value should therefore be attached to this book which contains information acquired by the author A. L. HOWARD during 40 years of business, during which he has probably purchased or imported, converted and studied the properties and uses of a greater variety of timbers than any other on an.

ELWES remarks on several points which will doubtess be rectified in after editions, but emphasises the fact that the account of the various timbers imported and known as mahogany is perhaps the most complete and accurate in the whole work, and the same may be said of the oak. Here for the first time in books on timber is found a good account of the beautiful form of this wood known as brown or red oak The causes which produce this change of colour in individual trees or parts of trees remain unexplained, notwith standing Prof. GROOM's investigation of the fungus found in some of the trees showing this change.

Reference to the " Jarrah " (*Eucalyptus marginata*) and other woods used for paving blocks, in which elm is not included, goes to show that the foundation on which the blocks are laid, coupled with the careful selection of wood, are very material points which have not in many cases been sufficiently considered.

A reprint of LASLETT's experiments on mechanical testing of the principal timbers is included, and also a chapter on the " Artificial seasoning of timber " by S. FITZGERALD.

398 - **American Trees for Forest Planting in France.** — BUTTRICK P L, (Assistant Professor of Forestry, Michigan Agricultural College), in *Journal of Forestry*, Vol. XVIII, No. 8, pp. 815-822, Washington D. C December, 1920

Recently there has been much discussion of the possibility of the use of American tree seed and nursery stock for forest planting in the devastated regions of France.

The author draws attention to the importance of understanding fully the nature of the species required rather than offering species suitable only for conditions prevailing in America. French foresters have for many years experimented with exotic species and are familiar with possibilities of planting some of the western conifers etc. The author has in this article made an annotated translation of the notes on American species taken from the list of exotics mentioned in the latest edition of a standard French textbook on forestry (2). According to a recent communication of the Director General of the Service des Eaux et Forêts to the American Forestry Association the seeds of certain species that are little known in France, will be given special care and study and will be planted in the nursery of the forest school at Barres. The national arboretum is located there, and most of the species mentioned have first been tested at this Institution.

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(1) " A Manual of the Timbers af the World " by Alexander L. HOWARD (Macmillan and Col. London, 1920, price 30s net,.

(2) See " Silviculture " by ALBERT FRON, Encyclopédie Agricole, Baillière et Fils, 19, rue Hautefeuille, Paris, 1918.

LIVESTOCK AND BREEDING

399 - **The Bacteriophagous Microbe** (1) **the Agent of Immunity in Pest and "Barbone".** — D'Hérelle, F. in *Comptes rendus de l'Academie des Sciences.* — Vol. CLXXII No. 1, pp. 99-100. Paris, January 3, 1921.

The author had hitherto only been able to study the bacteria-destroying microbe in intestinal diseases such as bacterial dysentery, enteric fevers, and fowl cholera ; in all these diseases, he isolated a bacteriophagous microbe attacking the pathogenetic agent. It still remained to be seen whether this microbe is only present in intestinal diseases, or whether it is a general means of protection.

In July, 1920, the author studied a severe outbreak of " barbone " that raged in western Cochin-China. From the excreta of buffaloes which had resisted the disease, the author isolated and cultivated a microbe that devoured the bacteria of " barbone '. It is only met with exceptionally in the excreta of buffaloes living in immune regions.

Immunity to artificial infection was produced by injecting into a buffalo a very small amount of serum obtained by the action of this bacteriophagous micro-organism upon a culture of the bacteria of " barbone ". From the excreta of rats that had survived an epidemic of rat-plague (to which were due some cases of bubonic plague localised at Bac Liew), the author succeeded in isolating a micro-organism that attacked Yersin's bacillus, the pathenogenetic agent of plague in human beings), and of which he was able to cultivate several generations. He proposes to ascertain the degree of immunity conferred by these cultures, and to study how they may be used as a prophylactic vaccin against bubonic plague.

The author states that, having occasion once to examine silk worm nurseries where *flacherie* was rife, he found that such insects as escaped the disease owed their immunity to a similar bacteriophagous microorganism.

The conclusion to be drawn from these researches is that the protection afforded by the action of these microbes is of general occurrence. Every time an animal recovers from a bacterial disease, or resists the infection, a race of bacteriophagous microbes that wage war upon the pathenogenetic agent can be isolated from the contents of its intestines. In cases of septicaemia, the subsequent passage into the circulatory system of the bacteria-destroying micro-organism can sometimes be momentarily observed. The normal and permanent habitat of the latter is however, the intestine.

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(1) See *R.*, April, 1920, No. 439. (*Ed.*).

400 - **Anti-Rabies Inoculation of Large Herbivora.** — FINZI G., and RONDELLI A. (R. Scuola Superiore di Medicina veterinaria di Torino, Istituto antirabbico Pasteur dell'Ufficio d'Igiene di Torino), in *La Clinica veterinaria* year XLIII, Nos. 17 to 19, pp. 457-463, Bibliography of 18 works. Turin September-October, 1920.

The authors hope that the Sanitary Authorities will advise the anti-rabies inoculation of all large herbivora that have been bitten by another animal suffering from rabies, or suspected to be affected by that disease. Hitherto the law has required that all such herbivora should be immediately killed. In order to show that anti-rabies inoculation is capable of effecting a cure, the authors mention the case of a draught-horse, which although it was not subjected to this treatment until the 12th day after being bitten by a mad dog. nevertheless recovered completely.

For the inoculation of large herbivora, the authors advise the adoption of RIEMLINGERS' method, with the modifications they have introduced: the sub-cutaneous injection of a complete emulsion, in 150 c.c. of distilled, sterilised water, of the entire brain of a rabbit with fixed virus, that has been 72 hours in ether. At intervals of 4 days, 2 other injections are given similar to the first. In the 10th day, a last injection is made with the same emulsion, which however, must only have been 48 hours in ether.

According to the authors, the fixed virus-ether method of vaccination will also given certain results, provided it is carried out as follows: — 1st injection the same as the above-mentioned; 2nd injection *idem*, but at an interval of 3 days from the first, 3rd injection after 3 days, the virus used having been 60 hours in ether; 4th injection, after 3 days, with virus that has remained 48 hours in ether. The duration of the anti-rabies treatment is from 9 to 10 days.

401 - **Distemper of the Pig.** — MCGOWAN J. P., in *The Scottish Journal of Agriculture*, Vol. III, No. 4, pp. 407-414, Bibliogr. of 6 works. Edinburgh, Oct. 1920.

A discussion of the occurrence of this disease as a pure epidemic among pigs without any complicating factor, introduced by new arrivals into a formerly healthy piggery. The usual symptoms associated with distemper were exhibited, but attention should be drawn to the so-called distemper smell which showed a peculiar resemblance to the so-called doggy smell " also noticeable in the case described '.

A post-mortem examination showed that nearly the whole of the lung of the right side, and the left lung, with the exception of the posterior lobe were in a state of grey hepatisation. The heart etc. showed no evidence of disease.

The author has recommended the precautions which should be taken to avoid the spread of this epidemic including vaccination, isolation, feeding, care of the styes etc. Antiseptics and disinfectants should not be used in the piggery except for washing the boots before entering the pens. Emphasis is laid on the fact that cats and dogs etc. should be rigidly excluded from the piggery, owing to the following interesting and important fact:— While the disease was at its worst previous to the initiation of the above mentioned recommendations, 4 dogs on the farm took distemper, 1 died, 2 were shot owing to the far advanced stage of the disease and 1 only recovered. The fact that this epidemic occurs amongst dogs may possibly contribute towards the devising of a method for combating the said disease, far more effectually than all other remedial measures previously undertaken. Prophylaxis by means of a vaccine prepared from cultures of the distemper organism cannot be regarded by any means as the most important agent used in its subjugation.

After complying with the recommendations mentioned in the infected piggery in question, within 2 months, out of 100 pigs born, 15 were killed off because they showed signs of some disease in an advanced stage, none died of distemper, and at the end of these 2 months, the disease could not be detected in the piggery.

402 - **Stephanurosis of Swine and Its Pathenogenetic Agent.** — SKRJABIN, K. J., in the *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 1, pp.47-54, Bibliography of 26 works. Paris, January 12, 1921.

In 1834, NATTERER discovered, in Brazil, in some Chinese pigs, nematodes localised in the adipose peri-renal tissue, and enclosed in cysts containing one or more of these parasites. The nematodes were studied from the zoological standpoint by DIESING, and named *Stephanurus dentatus* Dies (1839). Subsequently, they were found in the most different parts of the world (America, Africa, Australia, and the Far East). In spite of its wide geographical distribution, and the large amount of scientific literature of which this parasite has been the subject, its zoological characters have not yet been determined. The author gives a description of the males of this nematode, which he has able to study in the helminthological collection at the zoological museum of the National Academy of Science at Petrograd. (There were no female specimens in the collection).

403 - **Spontaneous Pyobacillosis in Rabbits.** — COMINOTTI, L. (Istituto di Igiene e Polizia sanitaria della R. scuola Superiore di Medicina Veterinaria in Milano), in *La Clinica Veterinaria*, Year XLIV, No. 3, pp. 45-60, Bibliography of 39 works. Milan, February 15, 1921.

A distinct disease of enzootic character and chronic nature, sometimes breaks out among tame rabbits kept in hutches. It is distinguished by the formation of abcesses in the sub-cutaneous comnective tissue of different parts of the body. The author has discovered that the pathogenetic agent of this malady is a variety of *Bacillus pyogenes, i. e., B. p. cuniculi.*

404 - **The Prophylaxis of Poultry Diseases** (1). — TERNI, C, (Co-Director of the Station for the Control of Stock Disease, Milan, in the *Giornale di Medicina veterinaria*, Vol. LXIX, No. 46, pp. 667-672. Turin, November 13, 1920.

The observations made by the author in 1920, at the time of a widespread epidemic of fowl cholera affecting the poultry in nearly all the provinces of the valley of the Po, prove that breeding-birds usually remain immune, or soon recover from the disease, which however rages among chickens hatched during the year, and of the age of 2 or 3 months. The susceptibility to infection increases after the age of 4 months. In this epidemic, as in all preceding outbreaks of the malady, it was found that the infection increased with the intensity of the poultry-trade, that is to say, when large quantities of young fowls changed hands (from July onwards), and the severity and virulence of the disease diminished with the fall of the later summer and early autumn rains. As compulsory sanitary measures for preventing poultry diseases, the author advises:—

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(1) For Poultry Diseases see also: *R.*, Dec., 1915, No 1313; *R.*, May, 1916, No. 533; *R.*, July, 1917, No. 646; *R.*, April, 1918, No. 438; *R.*, April, 1920. No. 439; *R.*, Oct., 1920, No. 1005. (*Ed.*)

1) Prohibiting the contamination of running water by throwing into it the viscera of fowls, or by washing in it poultry that have died of disease or been killed because of it.

2) Isolating all poultry (especially webbed-footed birds) in an enclosed space until the disease has died out in infected localities.

3) Prohibiting all trade in poultry in infected districts, the exercise of more careful supervision of markets and shops where poultry is sold retail (especially near the limits of the "octroi"), for as a rule, there is a tendency to despatch infected birds to the markets of the great towns.

As regards prophylaxis, it is necessary not only to vaccinate and revaccinate the old birds, regularly every year, but also to treat the chickens when they are about 2 months old, for vaccination at that age protects them from the disease during the sale time (about 1 year).

The experiments carried out on a large scale by the author during the epidemic have shown the advantage of using, for vaccination again fowl cholera while the disease is developing, a vaccin obtained from cultures in broth (preferably in chicken-broth), which have been kept for 4-5 days at 38° to 40° C., and then killed by the addition of 0.5 % of carbolic acid and 1 % of ether. In these cultures, the number of bacteria is somewhat limited, whereas the exogenous toxins, to which is due the first vaccinal reaction that enables the organism to defend itself immediately against contagion, are present in large quantities. Five to eight days later, fresh inoculations can be made; they will increase the power of resistance acquired some hours after the first inoculation which, as a rule, is sufficient to protect the poultry during the period of the epidemic. After the 3rd inoculation, the birds can usually ingest infected viscera with impunity, even if containing amounts of virus that would with difficulty be exceeded under natural conditions. They can even resist inoculation with virulent blood; this protects them against the possible transmission of the disease by means of blood-sucking insects.

The doses of vaccin-culture to be given are as follows:—

1 c.c. for chickens over 2 months old.
2 c.c. for ducklings, goslings, and young turkeys.
3 c.c. for adult ducks, geese and turkeys.

For the preparation of the serum, the author used, by preference, donkeys and mules, and obtained an excellent product by subjecting the animals to a course of treatment lasting 2 months.

[404]

Equidae are very susceptible to the bacillus of fowl cholera, therefore the first subcutaneous inoculation must not exceed 0.25 to 0.5 c.c. of a 24 hours' culture in broth. After 8 days, a subcutaneous injection of 3 c.c. can be made; this should be followed by one of 5 c.c., and subsequently by an endovenous inoculation of 10-100 c.c., as soon as the reaction caused by the last subcutaneous injection is finished. When a dose of 50 c.c., in the form of an endovenous inoculation, produces no bad effects, a serum is obtained, 2 c.c. of which will cure fowls suffering from a severe attack of the disease; it is however, advisable to repeat the dose during the course of 24 hours.

The serum thus obtained also serves for sero-prophylaxis, and if administered in doses varying from 2 to 5 c.c. according to the weight of the bird, will protect it for over one month dating from the period of contagion.

405 - **Test of the Value of some Concentrated Commercial Foods in the Trentino, Italy.** — GRAMATICA and SERINGHETTI (San Michele Experiment Station), in the *Bolletino del Consiglio provinciale di Agricoltura*, Vol. XXXIV, No. 3, pp.36-38. Trent, February 15, 1921.

At the Agricultural Experiment Station of San Michele (Province of Trento), the authors, in order to be able to reply to the repeated questions of agriculturists, carried out experiments with certain concentrated foods, which were on sale in large quantities at the end of 1919, viz., " moko " (flour of *Vicia Ervilia*), " fruges lin ", " palmes " and " panello di seme di pomodoro ". (tomato seed cake). As a control, " son pour vaches " (" cow bran ") was used. Each food was tested on a lot of 4 cows, 4 other cows being used as a control group. The results obtained were as follows; —

The bran did not increase the live weight or the milk yield. " Palmes " was tried twice on different animals; the average increase in live-weight was 13.3 kg., and 11 kg. per head in 15 days, but the average milk yield decreased, respectively, by 2.42 kg. and 7.2 kg. per head.

The " fruges lin " gave an average increase in weight of 12 kg. per head, and produced no difference in the milk yield.

The tomato cake, as compared with " palmes ", gave a slight increase in live weight (4 kg. per head in 15 days), but the milk yield decreased in that time by 4.4 kg. per head per day.

The conclusion arrived at was that these 3 foods were better suited for draught cattle and those to be fattened for the butcher, than for milch cows.

" Moko " has proved very well adapted for feeding hogs. This flour, which has only been on the market a few years, should be fed dry, or soaked in cold water. On account of its rather bitter taste and characteristic smell, the animals do not eat it readily, and some breeders have reported that there have been cases of death amongst their pigs after the use of this flour. In the experiments made by the authors, it was given cooked (400 gm. being added to the ordinary fodder at first); this amount was gradually increased up to 700 gm. per head per day.

The average live-weight increase was 400 gm. per head per day, and even reached 640 gm. No injurious effects were observed. The authors are of opinion that " moko " is an excellent feed for pigs, and probably also for cattle, provided it is cooked. In this form, it is better liked by the animals, and all possibly injurious substances have been rendered innocuous.

406 - **Experiment with "War Forages"** (1) **in Germany, Hungary, Switzerland and France.** — I. Honcamps, F. and Blanck E., Untersuchungen über den Futterwert der Nebenprodukte und Abfälle der Obst- und Traubenweinbereitung (Mitteilung der landw. Versuchsstation Rostock i. M.), in *Die landw. Versuchs-Stationen*, Vol. XCII, Nos. 5 and 6 pp. 275-290, numerous plates, Berlin, 1919. — II. Honcamps, F., Nolte, O. and Blanck, E., Weitere Untersuchungen über die Zusammensetzung und Verdaulichkeit einiger Kriegsfuttermittel, in *Die Landw. Versuchs-Stationen*, Vol. XCIV, p. 153, Berlin; reprinted in *Zentralblatt für Biochemie und Biophysik*, Vol. XXII, No. 6, p 354, Berlin, June 22, 1920. — III. Weiser, S. and Zaitschek, A., Über Strohaufschliessung aus der Königl. ungar. tierphysiologischen Versuchstation in Budapest), in *Die Landw. Versuchs-Stationen*, Vol. XCVII, Nos. 1-2, pp. 57-92, 6 tables, Berlin, 1920. — IV. Rapport de l'Administration centrale des établissements fedéraux d'essais et d'analyses agricoles sur les essais effectués durant la periode 1913-1919, presented by Dr. A. Schmid, Central Administrator, Berne-Liebefeld, in *Annuaire agricole de la Suisse*, Year 21, pp. 1-17, bibliography of 23 works. Lucerne, 1920. — V. Gouin R , Les substitutions alimentaires dans la ration du cheval, in *La vie agricole et rurale*, vol. XVIII, year 10, No. 1, pp. 1-4, Paris, January 1, 1921.

I. — The dearth of forage that prevailed during the war caused it to be replaced to an increasing extent by the by-products of wine-making. Poot gives the composition of the fresh pomace of apples, pears, and grapes, and Sooboda that of the same pomaces after ensilage.

Formerly, the nutritive value of grape pomace was much over-rated, until Weiser showed that it is much less than that of hay of average quality. If, however, the grape-stalks are removed, the value of the residuum is much increased.

The authors carried out their experiments with dark and light apple pomaces, with ordinary grape pomace powder, and with Neuss grape powder which is said to have been disintegrated, in order to render it more digestible. The authors give some analyses. The animals used in their experiments were 2 adult Rambouillet sheep, and the basal ration consisted of hay mixed with poppy-cake.

The authors confirm the preceding results obtained by Kellner and conclude that dry apple pomace, and probably also pear pomace. can be used as a feed in all cases, but that there are great differences in the composition of this substance, which depend upon the raw material and the method of preparing it (2). On the other hand, dried pomace powders should be considered as roughage with a nutritive value which may be compared, if not exactly to the straw of cereals, at any rate to rice waste.

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(1) For concentrated cattle foods used during the war, see *R.*, Feb., 1920, No. 223. (*Ed.*)

(2) For apple powder, see also *R.*, april, 1920, No. 442. (*Ed.*)

II. — Feeding experiments with sheep, lasting for 8 days, the basal ration being hay to which were added the following war foods: — (1) Mixture with extract of rumen; (2) a gelatinised feed comsisting of spelt husks, gelatin, buckwheat flour and condiments; (3) chopped maize stalks; (4) the seeds, or rather the integuments, of the seeds of sugar-beets; (5) ground bean pods; (6) nettlemeal, probably a residium from the extraction of texile fibre; (7) sugar-beet stalks. The authors give analyses and tables.

The first food, as Morgen said, can be regarded as of nearly the same food value as coarse wheat bran (1).

The second contains nitrogenous substances in a very digestible form, whereas the digestibility of the other matters is low (even below 40 %), and if the raw protein falls below 8 %, this food has but little value. Certainly where there is a dearth of feeds rich in protein, the gelatin is worth taking into consideration.

The third food is comparable to chaff, and can be used with success for ruminants, and even for horses, but is not at all suitable for fattening pigs.

The fourth food gave bad results, owing chiefly to the large amount of indigestible fibre present.

The fifth food has the same nutritive value as pea-pod meal.

The sixth food is of less value than straw, and is thus only a bulky feed.

The seventh food is equivalent to the leaves and crowns of beets.

III. — The scarcity of forage also in Hungary during the war caused attention to be given to the disintegration of straw. Out of the many processes employed for the purpose, the Ministry of Agriculture chose the Lehmann pressure system. In 1918 the authors repeated the preceding experiments made by Altmannsberger in 1903. They took 2 adult sheep and gave them a basal ration of hay with disintegrated straw, the amount fed being from 220 to 550 gm. of dry matter per head per day. Sometimes 25 gm. of blood meal was added. The forage remained the same throughout the experiments, and its composition was always known

The disintegration of straw for 4 hours under a pressure of 4 atmospheres, in a boiling lye of caustic soda, increases the digestibility of the fibre and of the nitrogen free extracts by 12,13 and 25 %, respectively. The concentration of the alkaline lye has little effect upon the digestibility of the mixture and acts differently upon the various substances; thus a higher degree of concentration increases the digestibility of the fibre whilst it decreases that of the nitrogen-free extracts.

The experiments show that the Lehmann pressure method is capable of considerably increasing the nutritive value of the straw of winter cereals; and that the best way of disintegrating the chopped straw consist in boiling it for 4 hours in an autoclave under a pressure of 4 atmospheres;

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(1) For experiments made in Italy with the contents of the rumen as cattle food, see *R.*, May 1919, No. 621. (*Ed.*)

1.5 kg. of 96 % caustic soda and 200 litres of water being added per quintal of straw. In this manner, a tasty food with an appetising smell, and decidedly acid reaction (1) is obtained that can be directly fed, and of which the nutritive value, always allowing for the absence of digestible albumen, is equivalent to the nutritive value of best hay. Although the disintegration entailed a loss of 11-14 % of the dry matter, yet even when allowance is made for this loss, the starch content of the crude straw is found to have been increased from 56-77 % by the process.

The authors think that the best and most practical method is to prepare a large quantity of the straw by LEHMANN's pressure method, using an autoclave of 14 cu. m., sufficient to provide food for 250 head of cattle daily.

They also made comparative experiments by varying the method of disintegration.

In the 2nd experiment, the straw was disintegrated under ordinary pressure, by boiling it for 6 hours in an alkaline lye composed of 8.3 kg. of caustic soda, and 240 litres of water per quintal of straw. This method under ordinary pressure, necessitated a strong concentration of caustic soda, and as soon as the operation is finished the straw has to be washed in water until the alkali is removed and then quickly dried at 30° or 40° C. These successive washings, not only remove a large amount of the dry matters, but the non-nitrogenous extracts are much less available than when the operation is carried out under pressure. The digestibility of the crude fibre is but little increased. This 2nd method entails a great deal of work, expense, and precautions that are unneccessary in the case of the 1st method. Further, it has been proved that disintegrated straw economises albumen to a greater extent than entire straw or hay.

A 3rd experiment for the purpose of ascertaining the effect of caustic soda upon the disintegration process, was carried out by treating the straw with steam alone, or with steam and lye together. The treatment with pure steam decreased the dry matter of the straw 3 %, and it was found, by feeding experiments with horses and sheep, that although steam treatment increases the digestibility of crude straw, it does not do so to the same extent as the combined treatment. Moreover, the straw, when merely steamed, was stiffer and less appetising, as well as less economical of nitrogen, than when boiled in soda lye. Steamed straw is, however, preferred both by horses and sheep, hence good qualities of straw may well be treated in this manner, although it is chiefly useful for woody straws of inferior quality. This remark also holds good, and even to a greater extent, in the case of alkaline disintegration. Steamed straw, and still more alkalised straw, have a more beneficial dietetic action than the crude product.

Kitchen salt added to the straw before steaming decreases the digestibility of the crude fibre.

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(1) Due to the liberation of acetic acid. (*Ed.*)

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The authors obtained a very soft, but appetising straw with an agreable smell, by treating it with slaked lime. But, in this case, as when soda is used, under ordinary pressure, the straw needs thorough washing before it can be fed. Further the lime method seems to have no advantages over Lehmann and Beckman's systems (1).

IV. — Since 1913, the Central Administration of the Federal Agricultural experiment and Analysis Stations of Switzerland has tried to extend agricultural experimentation further by dividing the work among the Stations of Oerlikon, Berne-Liebefeld, and Lausanne. Moreover, the scarcity of the food supply during the war, and the resulting introduction of the most varied substitutes, necessitated the different products being subjected to preliminary scientific experiments.

The Report of the above-mentioned Central Administration announces that the account of the manurial and cultural experiments still in progress will shortly be published. It will be sufficient to mention here the forage experiments; although the experimental period has been necessarily short, conclusive results have nevertheless been obtained. *Robustine* is a substantial food that keeps well ; it is made of dried blood, and contains 8.8 % of digestible albumen, Calves will not eat it. The author adds that ruminants, as a general rule, have an aversion to foods containing blood (2).

The distilled and dried pulp of fruit (pomace powder), and dried maize-stalk meal were fed to milch cows; the former were readily eatem, but the animals would not touch the latter, or account of their burnt smell.

All the cattle ate fresh fruit pomace with avidity; but Emmenthal cheeses made from the milk of cows fed with this pulp had a curious flavour, and special notes on the subject were communicated to stock-breeders.

Wood-sawdust, known as *nemolin*, was refused, together with the other forages with which it was mixed.

The feeding experiments made with the by-products of milling (*bran* and *middlings* of which the authors give the analyses) from the same wheat, whether damped or not before grinding, confirmed the results obtained by Wiegner, which proves that it is impossible to determine with certainty whether grinding corn will increase the nutritive qualities of the by-products of milling.

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(1) For Lehmann process, cf also Kellner, *Die Ernährung der Landw. Nutztiere*, Parey, Berlin, 1916, p. 281. For Beckmann's system, see Fingerling and Schmidt, "Die Strohaufschliessung nach dem Beckmann'schen Verfahren," in *Die Landw. Versuchs-Stationen*, Vol. 94, p. 115. Berlin, 1919.

Fingerling and Schmidt, from their experiments on sheep, conclude that the cold disintegration of straw under ordinary pressure, with a 1.5 % soda lye, as recommended by Beckmann, must continue at least for 1 ½ hours and preferably for 3 hours, if the maximum increase of digestibility is desired. Beckmann advises the process being continued for 2 hours. (*Ed.*)

(2) According to Kellner and Pott, this statement would seem incorrect (*Handbuch der tierischen Ernährung und der landw. Futtermittel*) 1909, Vol. III p. 515. (*Ed.*)

The *mixture of forage flour* composed of the by-products of milling and Dari flour, or that made from canary-grass (*Phalaris canariensis*), millet, and vetch (*Vicia Ervilia*) has no bad effects upon pigs, if fed cooked and immediately after cooking, at the rate of 0.7 kg. per head per day.

Colza and sunflower cakes from Rumania do no harm to cows, if given in the proportion of 1 kg. per head per day. Colza cake, when fed alone, was refused by the animals.

Poultry will eat 30 gm. of dry cockchafers (*Melolontha*, sp.) daily without any unpleasant taste being imparted to the eggs.

Cereal flour gives better results when dry than soaked, from the point of view of milk yield.

First-class Emmenthal cheese, when made from the milk of cows given moderate quantities of sesame cake and rye flour, showed no anomalies or defects.

No effect was produced by giving milch cows for 12 weeks 3 gm. of calcium chloride per quintal of live weight per day in their drinking-water. Seeing the good results obtained in Germany (1), the author concludes that further and longer experiments are necessary.

Special interest has been aroused in Switzerland as to the ensilage of green forage. While awaiting the general report to be given at the conclusion of the experiment with the *Herba* system, it may be said that, under certain conditions, it is a good means of increasing the gross return of meadows, and consequently extending the forage crops. Emmenthal cheese, however, can not be made from the milk of cows fed on ensilage.

During the war, improvements were made in LEHMANN's method of disintegrating straw by the alkaline process. The Chemical Laboratory of the Zurich Polytechnic advises that the straw, after having been boiled 6 hours in a caldron with alkaline soda, should be neutralised by the addition of a little sour whey. Feeding experiments made on pigs and cattle have shown that straw thus treated, though appetising and a suitable food, is not sufficient for young animals, unless albumen is added. The use of the system, which is best carried out on a large scale, is, however, subordinated to its cost. In another experiment, made at Liebefeld, with straw treated in the cold with caustic soda, and subsequently neutralised by the addition of ensilage, the mixture was eaten by the cows with avidity, though their milk was not suitable for cheese-making.

Other war forages were intended as substitutes for oats and hay, and consisted of fibre treated by the LEHMANN process, albuminoid and starchy substances being added. Experiments have shown that these substitutes were far from equalling the originals, but they should nevertheless be regarded as good supplementary foods in times of scarcity.

Another substitute for oats, known as *Sadhaco*, was not at all a favourite with cattle.

V. — During the war, more than half the usual oat rations of the French Army horses had to be replaced by substitutes. Horses, however, are more sensitive than any other animals to traces of poison which are present in plants and vary according to the conditions of their growth. Poisoning, moreover, is not the only danger threatened by substituting other substances for oats in the rations fed to horses.

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(1) See *R*, 1918, No. 64. (*Ed.*)

Wheat and barley are cereals that suit horses very well. Barley used to be the sole food given to the horses of the Roman army, and horses in Africa and the East have nothing else (1). It is advisable, in order to render the awns innocouous, to cook or otherwise soften the barley, or also to crush it, but care must be taken not to reduce it to powder, for in this form it is injurious to horses.

As rye is never thoroughly masticated, it should be broken up or boiled. Great care must be used not to feed horses with rye that may be infected with ergot.

Maize has long been used; it should be crushed, but not made too fine.

Sorghum, which is imported into Marseilles under its Greek name of *Dari*, or the Egyptian ones of *Doora*, or *Doura* (2) is usually employed for distillation. The sorghum grown in Provence provides corn for the poultry-yard, but during the war it was crushed and fed successfully to horses.

Paddy was also used in the form of sharps, but in order to prevent rachitis, forages rich in lime were added, or else 15 gm of washed chalk per ration.

Molasses, like all foods containing sugar, is very good for horses, but they should not be given more than 2.5 kg. per head per day.

Tubers and roots were also dried for use as stock feeds. In Switzerland and Germany, potato flakes were prepared during the war, and *cossettes* of manioc were imported into France from Madagascar; these feeds have to be softened before use.

Carobs were used with great success in France for the Army horses, and replaced as much as ½ the grain ration. The pods were selected and pounded, all the seeds above 1 % being carefully removed. Whenever these precautions were neglected, bad and even fatal results ensued, owing to the obstruction of the intestines, and also, according to the author, to other undefined causes of which the quality of the fruit, its state of preservation, and its origin appeared to be the chief (3).

Oats were also partially and successfully replaced by groundnut cakes. They make an efficient substitute, but care must be taken to avoid those containing the smallest amount of ricin (4).

(1) This is also the case in Sicily (*Ed.*)

(2) According to some authors, *Dari* is a cultural variety of *Sorghum vulgare* which is called *Doura* by the Egyptians; according to other authorities (KELLNER, for instance) it is a distinct species, *Sorgum tartaricum* (See, POTT l. c. pp. 160 and 492. (*Ed.*)

(3) The necessity of crushing carob-pods is a vexed question. At Naples the cab-horses are given bran and whole carobs. See also *R.*, Dec., 1918 No. 1380, and *R.*, Jan., 1919, No. 80.

(4) It appears that the toxics properties of ricin can be removed by heating. See *R.*, June, 1920, No. 672. (*Ed.*)

Cacao pods, which had hitherto been given to ruminants, were also fed to horses during the war. The latter animals are, however, very susceptible to theobromine (1).

407 - Experiment in Breeding Goats with Supernumerary Horns, in Germany. — MULLER, R., in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, No. 2, pp. 13-14. Hanover, January, 1921.

The author, in continuing his researches on the effect of in-breeding goats possessing supernumerary horns (the results of which he published in the *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, 1912, Vol. III, Part. 3 (2), carried out some new experiments in 1913-1917, for the purpose of obtaining experimental proof of the accumulation of hereditary tendencies, and of the increased development of individual physical characters.

The male resulting from the first experiments had six roots of horns, two of which were fused together from birth. This animal was mated with:— (*a*) its mother; (*b*) its aunt; (*c*) its sister; (*d*) a daughter, the issue of the last mating. In spite of this very close blood-relationship the offspring never had more than four horns. Thinking that the cause of non-transmission was to be found in the loss of reproductive power of the male, which was the product of the union of brother and sister, the author proceeded to introduce some fresh blood by using a small, black-coated, male Angora hybrid.

The results of the different matings of this animal were as follows:—

(1) With a two-horned dark fawn-coloured goat (the mother of the six-horned male):— A male and a female with two horns, and one male with four horns.

(2) With a four-horned goat (sister of the male which, mated with the other dark fawn-coloured sister, produced a six-horned male; aunt of the latter):— One male and two females, all with four horns.

In order to increase the consanguinity, the male resulting from the mating of the four horned goat and the hybrid Angora he-goat was mated with one of its own sisters.

The offspring of this union was a white male possessing already shortly after birth, eight roots of horns, of which two fused, thus leaving only 5 to develop further.

The offspring resulting from mating a son of the hybrid male Angora with a two-horned goat, and that of the union of eight-horned male with related females, always showed an increase in the roots of the horns. The product of the union of the eight horned male and its mother was a kid with seven roots of horns; when the eight-horned male was mated with a related two-horned female, the offspring was a kid with 5 roots of horns.

According to the author, these results show that in-breeding preceeded by the introduction of fresh blood, brings out hereditary tendencies, and increases their power of development.

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(1) See *R.*, May, 1920, No 548. (*Ed.*)

(2) See *R.*, Nov., 1912, No. 1546. (*E*.)

[406-407]

408 - **Heredity in Rabbits** (1). — VECCHI, A. (Zoological Institute of the University of Bologna), in *Natura*, Vol. XI, pp. 143-169, 4 fig., Bibliography of 16 works, Milan, 1920.

All authors admit she existence of two geographical races of the common European rabbit (*Oryctolagus cuniculus*), viz., the typical European breed (*O. c. cuniculus*) living in Northern Europe, and the British Isles; and the Mediterranean breed (*O. c. huxleyi*), found in the Mediterranean region.

The author passes in review preceding works dealing with the transmission of the characters of these two races and of their hybrids, and described his own experiments.

VARIATIONS IN SIZE IN TAME RABBITS AND THE TRANSMISSION OF THESE CHARACTERS. 1) There are two distinct types of rabbit characterised by the different proportion existing between the length of the tarsus and that of the body; 2) it is difficult, and perhaps even impossible, to distinguish races by their weight and dimensions, for these characters vary between two extremes, and present a series of intermediate variations (2); 3) it is probable that the giant breeds, especially the Flanders giant rabbit, are the result of crossing lop-eared rabbits with macropodous rabbits with normal ears because in the first place, the ears of the latter are always very long, and in the second, individuals are often born with one, or more rarely, two pendent ears, a defect showing the effect of the crossing with the lopeared rabbit.

THE COLOUR OF WILD RABBITS AND ITS FACTORS (3). — According to CASTLE, the wild grey rabbit owes its special hue to the existence of a chromogeneous substance (C) of 3 colours; yellow (L), brown (Ph), and black (M) distributed in a varied and determined manner on the hair of the upper parts of the body alone (Ly) and in a uniform manner (H), but so that the yellow of certain zones and of part of the coat has a limited extent (E). If the E factor is alsent, the black and brown colouring is confined to the eyes, or at most to the extremities, because the yellow is no longer limited to any particular part, and the whole coat is of that colour. Should the factor H be absent, the chromogene is no longer uniformly distributed, and the coat is spotted with white.

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(1) See *R.*, Oct., 1915, No. 1060.

(2) The differences are explained, if we suppose (CUÉNOT, CASTLE), that the quantitative characters do not depend upon a single invariable factor, but rather upon an inconstant determinant, which produces reversible, quantitative variations.

On the other hand, NILSON-EHLE and JOHANNSEN, basing their opinion upon the hypothesis of the absolute constancy of the "genes," maintain that quantitative characters (both in animals and plants) do not depend upon a single determinant, but upon a group of independent factors (polymery) the dominance of which does not appear in the 1st generation. These factors are segregated in the 2nd generation, wich reduces the number of individuals resembling the parents (pure), through the increase of competing factors. In selection however, it would always be possible to separate stable combinations, and thus obtain pure, invariable lines. (*Author's Note*)

(3) See *R*, Oct-Dec. 1919, No. 1220. (*Ed.*)

The absence of the myochromogenous factor (My) permits of the mixture of the different colours, in which case the rabbit is entirely black, for between the colours yellow, brown, and black a kind of order of precedence exists, and black conceals brown.

If the pycnogenic, or intensity factor, P, is wanting, its opposite, p., weakens the colours, replacing black by blue and fawn-yellow by cream-yellow.

When the chromogene C is absent, the pigment disappears and the rabbit is entirely white.

The three other factors, the luteogenetic, phaeogenetic, and melanogenetic, respectively, are always present, even if the rabbit is white, but in the absence of the chromogenetic substance, they are suppressed

Colour transmission. — The factors present in the wild grey rabbit are all dominant as regards their negative antagonists. The grey colour of the wild rabbit is dominant in respect to all other colours. Black is dominant, as regards blue and yellow, and these colours combined produce the grey coat of the ordinary rabbit. All the colours are dominant as regards white.

There is still much uncertainly as to the importance to be attribute to the different coat-markings. It is, however, possible that the factor H that represents all these variations, may be replaced by many additional factors which are not transmissible according to the laws governing dominance, but depend upon fusion, in the same manner as the quantitative characters relating to size.

Transmission of length of coat — Long hair like that of the Angora rabbit, is recessive in crosses with shorthaired rabbits. Coat length is independent of colour. The character "length of coat" follows the Mendelian laws of dominance, segregation, and independence of characters, and can be correlated with any character of shape, size and colour.

The Author's experiments. — These extended over 4 years, from 1916 to 1920, and were concerned with the heredity of colour in crosses between blue St. Nicholas rabbits, and Himalayan rabbits, between St. Nicholas rabbits and Silver-Greys (*Cuniculus argenteus*), the colour and weight of hybrids from crosses between Giant Flemish rabbits and Japanese rabbits; finally experiments on telegony (1) furnished a new hypothesis respecting telegonic heredity.

The results obtained proved the truth of the conclusions reached by Castle and other workers, and show that the formula invented by Castle to represent the gametic constitution of the wild grey rabbit corresponds to a group of actually existing "genes". The present author, however, doubts whether this formula includes all the genes; for it does not account for the silver present in all the fundamental colours. There are, further, some favourite old breeds, like the Chinchilla, or modern ones, such as the Havana, of which the gametic formula is unknown. Many colour "genes" do not follow Mendelian laws of heredity, but are transmitted in an intermediate degree, and in a variable manner, *e. g.*, the spots usually found on Himalayan rabbit, stripes on a yellow ground, the particular arrangement of colours in the case of silver-grey rabbits.

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(1) See *R*, July-Sept. 1919, No 930 (*Ed*)

What we known about the transmission of characters in rabbits enables us to state that the breeds, as defined by the respective standards, are nothing but conventional correlations of a certain determined number of fundamental characters. These, as compared with the wild rabbit are:— 1) Larger size; 2) greater length of tarsus in comparison to body-length; 3) long, pendent ears; 4) convex skull; 5) sub-jugular cutaneous fold (goitre of the Flemish rabbits); 6) long coat (Angora); 7) grey coloration; 8) uniform black coat; 9) uniform blue coat; 10) uniform yellow coat; 11) uniform white coat; 12) white spots; 13) coat with black spots on yellow ground; 14) coat spotted with white (silver); 15) coat with markings (Himalayan); 16) coat with dark black markings.

As many breeds of rabbits can be created as there are combinations between these characters, and the number could be still further increased, if variable characters were taken into account such as size, and new characters, like the Havana coat, of which the gametic formula is still unknown.

409 - **Effect of Excessive Use of Male Rabbits in Breeding.** — HAYS, F. A. (Wyoming Station), in *The Breedero Gazette*, Vol LXXXIX, No. 2-2040 p. 66. Chicago, Jan 13, 1921.

Report of experimnts with domestic rabbits at Iowa Station in 1916. Males usually performed 20 services at intervals of from 10 to 15 minutes.

Body weight and growth in body measurement were apparently in no way reduced by excessive breeding. The mortality rate in offspring does not increase with heavy breeding of te sire. The proportion of males to females seems, on the contrary, to be appreciaioy affected.

The table given shows that the sex ratio in the first service group was 129 males to 100 females, whilst the roth service group showed a ratio of 28 : 100. The same correlation evidently exists for the intermediary service groups (5th to 15th).

410 - **Results of Stallion Service at the German Stud Stations (Service Season 1919).** — MULLER, W., in the *Zeitschrift fur Gestütskunde*, Year XV, No. 10. Hanover, October 1920.

The author, as a result of questions sent to the various Stud Stations, obtained the following data respecting the Service Season of 1919 (See Table on page 448)

The figures given show that the number of unfertilised mares was very large in the Frederick-William Stud Station at Neustadt am/D. According to the author, this number of unfertilised animals could be reduced by subjecting suspected brood-mares to veterinary examination, and ascertaining by means of the microscope, the vitality of the spermatozoa of stallions which have served mares proving not to have been fertilised.

The figures referring to the fertilised mares are less accurate, on account of the omission to register the results obtained outside the Stud Station.

The statement made by the former «Oberlandstallmeister» VON OTTINGEN, as to the preponderance of colts over fillies appears to lack foundation. At Trakehnen, Graditz, and Beberbeck, unlike Neustadt, more females than males were born. The author proposes to study this question in the following years.

Chief Stud Stations.

	Trakehnen	Graditz	Beberbeck	Friederich Wilhem Stud Station	Total
Number of stallions	18	15	5	3	41
Number of mares served	362	215	108	70	755
Number of mares not registered	16 = 4 %	45 = 20.9 %	4 = 3.7 %	—	65 = 8.6 %
Unfertilised mares	99 = 28 %	73 = 33.9 %	30 = 68.6 %	36 = 51.4 %	238 = 31.5 %
Fertilised mares	247 = 68 %	97 = 45.2 %	74 = 68.6 %	34 = 48.6 %	452 = 59.9 %
Abortions	17 = 7 %	9 = 9.3 %	3 = 4 %	2 = 5.9 %	31 = 7 %
Twin births	2 = 0,8 %	1 = 1 %	—	—	3 = 0,7 %
Live foals	232	89	71	32	424
a) colts	110 = 47.4 %	43 = 48.3 %	31 = 43,7 %	18 = 56.3 %	202 = 47.6 %
b) fillies	122 = 52.6 %	46 = 51.7 %	40 = 56,3 %	14 = 43.7 %	222 = 52.4 %
Longest gestation period in case of colts (days)	354 days	360 days	354 days	348 days	354 days
Shortest gestation period in case of colts (days)	302 »	325 »	318 »	323 »	317 »
Average gestation period in case of colts (days)	337 »	342 »	340 »	334 »	338.5 »
Longest gestation period in case of fillies (days)	360 »	370 »	365 »	343 »	359.5 »
Shortest gestation period in case of fillies (days)	302 »	315 »	323 »	325 »	316 »
Average gestation period in case of fillies (days)	335 »	342 »	335 »	332 »	336 »
Number of animals bred that were kept at the stud station:					
a) station stallions	22	23	8	8	
b) brood-mares	10	25	12	11	
Number of horses rejected	—	76	10	33	

The great difference between the longest and shortest duration of the gestation period is most interesting; the causes of these differences are unknown (1).

The returns of the Stud Stations at Indenau (Brandenburg), Leubus (Silesia), Labes (Pomerania), Marienwerder (West Prussia), Wickrath (Rhine Provinces), as well as those of Redefin and Achselschwang, evidently cannot be correct, the information having been given by breeders. Nevertheless, here again, more female foals then male were stated to have been born.

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(1) MIECKLOV, in *Zeitschrift für Gestütskunde*, Year XIV, No. 8, p. 126. (*Author's Note*) — See *R.*, May, 1920, No. 554. (*Ed.*)

411 - New Scale of Points for judging the Breeding Qualities of Show Cattle.— Schmidt, B., in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXIV, No. 47, pp. 489-490. Hanover November, 1920.

On the occasion of the auction at the 23rd show held at Insterbourg in September, 1920, by the Herdbook Society of the Black Pied breed of Netherland cattle (Herdbuchverein für das schwarzweisse Tieflandrind) an entirely new scale of points was adopted in judging the animals entered, pedigree, shape, and milk-producting capacity being taken into consideration at the same time. The use of morphological characters as affording an index of milk-yielding aptitude was entirely abandoned, the actual milk yield of the female progenitors, as given by the records of societies for the registration of the performance of milch cows, being substituted for it.

As many as 9 points may be given for capacity for milk production, and the same number for type, coat, pedigree, general development and capacity for beef production.

Milk production up to 100 kg. of milk fat per annum only is taken into account. When the animals are of great value for breeding purposes, a higher capacity for milk production can be marked by giving additional points.

The method of scoring in detail is as follows:—

The breeding qualities of the cattle at the show were estimated by points; 36 points at the maximum can be credited to each animal; these are distributed as follows:—

(1) Type, coat, pedigree maximum point..	9
(2) Shape	9
(3) General development and beef-producing capacity (weight)	9
(4) Milk-producing capacity	9
Total	36 points

Meaning of the points in the score for capacity for milk production.

9 — very	Intermediate points will be given when required.
7 — good	
5 — fair	
3 — tolerably good	
1 — mediocre	
0 — very bad	

In judging bulls the performance of the mother as well as that of the other female progenitors are taken into consideration. The digestive capacity of the animals, on account of the impossibility of feeding them normally, was left out of consideration.

The number of points for capacity of milk production varies between 5 and 9, according to the fat content of the milk :—

5	points	for	60.0 — 69.9	kg.	of	fat
6	»	»	70 0 — 79.9	»	»	»
7	»	»	80 0 — 89 9	»	»	»
8	»	»	90.0 — 99.9	»	»	»
9	»	»	100 0 — and over, kg. of fat.			

Animals that can be credited with altogether more than 20 points for type, coat, and offspring, as well as for symmetry, general development, and capacity for beef production, can also be given 5 additional points for good capacity for milk production.

This points are distributed as follows:

10	points	for	110.0 — 119.9	»	»	»
11	»	»	120.0 — 129.9	»	»	»
12	»	»	130.0 — 139.9	»	»	»
13	»	»	140.0 — 149.9	»	»	»
14	»	»	150.0 and over	»	»	»

These figures include the pre-war and post-war returns. The former are estimated separately at the Commissariat.

412 - Observations on the Correlation Between Length of Horns and Age in Young Cattle of the Brown Alpine Breed in Italy.

—BRENTANA, D., (Zootechnical Institute of the Veterinary College [*Scuola superiore*] of Parma), in the *Nuovo Ercolani*, Vol. XXV, Nos. 21-22, pp. 265-277. Turin, November 15-30, 1920.

It is well-known that a positive correlation exists between the length of the horns and that of the coat in cattle, and that, generally speaking, the horns are shorter in proportion to the earlier maturity of the breed.

The author gives a short summary of numerous works dealing with the factors influencing horn development in cattle, as well as of the researches of FAELLI, CORNEVIN and LESBRE, KRAEMER, MASCHERONI, PERGOLA and LESBRE, on the determination of the age of calves from the length of their horns (the above-mentioned writers do not all agree). He then gives data (see following Table) referring to calves of the brown Alpine breed, which were born at the Central Cattle Dépôt of the IV Army, of cows commandeered in the Province of Cremona and reared under similar conditions.

The data collected by the author show that the growth in length of the horns is not so regular that there is any exact correspondence between the age of calves and the length of their horns. Nevertheless, until about the 6th or 7th month, the variations in the average length are less than those occurring later. Therefore, the measurement of the horns may give approximate data for determining the age of the animals from 6-7 months old, after which time, the approximation continually decreases. The age of heifers is given correctly by the length of the horns in centimeters plus 2 ; that of bull-calves by the length of the horns in centimeters plus 1 (in the brown Alpine breed, the horn development is more rapid in the males than in the females). When the animals are over 2 months old, the following data may be used:— The bony protuberance which is the first sign of the appearance of the horn is perceptible beneath the skin towards the 15th day; after about 1 month, the nucleus of the horn appears, free from hair; when the calf is between 1½ and 2 months old, the small horns begin to grow.

The author has also observed that a larger circumference is connected with greater length of horn, and that, up to 18 months, the horns grow more in circumference than in length; when the calf is older, however, the reverse is the case.

Horn Development in Young Cattle of the Brown Alpine Breed.

Age in months	Females				Males			
	No. of observations	Average length mm	Maximum length mm	Minimum length mm	No. of observations	Average length mm	Maximum length mm	Minimum length mm
2– 3						16.00	20	12
4– 5	9	28 85	35	22		31.75	37	28
5– 6	15	35 93	50	28	15	43.93	62	30
6– 7		48.16	63	40	9	73.11	125	43
7– 8		61.25	75	40	10	70 40	98	52
8– 9		70.33	78	57	5	71 20	87	62
9–10		74.00	74	74	6	87.00	97	80
10–11	2	94 00	110	78	5	84 60	102	56
11–12	1	72 00	72	72	2	96.50	100	93
12–13	1	102.00	102	102	11	102 81	120	85
13–14 . .	1	130.00	130	130				
14-15 .	—	—				117.50	120	110
15–16 . .	1	126 00	126	126				
16–17 . . .	3	149.00	162	125				
17–18 . . .	2	157.50	192	123		128 00	128	128
18–19 . .	7	168.85	202	138				
20–21 . .	1	182.00	182	182				
21–22 . .	1	190.00	190	190	—			
23–24 . . .	4	191 25	220	150	—			
24–25 . . .	4	194.25	223	160	—			
Total	76	—	—	—	78			

413 - **The Value of the Purebred Sire in Increasing the Production of a Scrub Herd.** — **Mc. Candlish, A. C., (Dairy Husbandry Section, Agricultural Experiment Station, Ames, Iowa) in** ***Journal of Dairy Science*** **Vol. IV, No. 1, pp. 12-23, tables 13, figs 9, Baltimore, Jan., 1921.**

Report of experimental tests made, at the Iowa Station, mating scrub cows purchased in Arkansas to pure bred dairy bulls of the Holstein, *Averages for two generations*

Group	Dams				Daughters			
	Number of cows	Number of lactations	Milk	Fat	Number of cows	Number of lactations	Milk	Fat
			lb	lb			lb	lb
Holstein . . .	3	16	3673 8	167 36	3	15	6757 5	275
Guernsey	3	13	4496 6	199 62	3	10	4843 8	229
Jersey .	2	13	3394 0	172 52	2	2	5460 5	298
Average	7	36	3847.0	182.40	8	30	5944.7	261.

Guernsey and Jersey breeds, with a view to testing the it value as regards increaseg in producing ability of the herd, (milk and butterfat).

The influence of good feed and care on the production of these animals was studied and also in breeding investigation, and results are shown in various Tables

A number of grade animals sired by purebred bulls (Holstein, Guernsey or Jersey) and descended from scrub cows was studied in 2 groups: the first generation grades, *i e.* those carrying 50 % of blood of one of the recognised dairy breeds, and the second generation grades *i. e* carrying 75 %.

FIRST GENERATION GRADES. — Purebred Holstein bull × scrub cow, showed in the first generation an increase over their dams in milk and butterfat production, with an average of 89 % in milk and 58 % in fat In the case of F_1. of Guernsey grade × scrub cow, the average increase in yield was 17 % in milk and 27 % in butterfat, and with Jersey grade × scrub cow, it was 22 % in milk and 34 % in fats

SECOND GENERATION GRADES. — The average increase in production for the second generation Holstein grades as compared with their scrub grand dams was 174 % in milk and 130 % in fat, In the case of Guernsey grades, 72 % in milk and 94 % in fat, and for Jersey second grades, 59 in milk and 74 % in fats

In the appended Table, the averages for two generations of grades and their scrub ancestors are givers.

The results obtained show clearly that the use of purebred sires is a sure way of increasing milk and butterfat production, if bred with a scrub herd, on condition that the bulls are selected carefully both fron the point of view of their heridity and also of their individual capacity.

les and their scrub ancestors

Grand daughters				Increase in production			
				First generation		Second generation	
Number of cows	Number of lactations	Milk	Fat	Milk	Fat	Milk	Fat
		lb	lb	%	%	%	%
5	9	10063.2	385.46	84	65	174	130
5	8	7744.0	388.23	8	15	72	94
2	2	5389.2	382.92	61	73	59	64
12	**19**	**8321.4**	**375.81**	**55**	**44**	**116**	**106**

414 – **Rearing Calves on Milk Substitutes** (1). — DECHAMBRE, in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol VII, No 6, pp 107-122, Paris, February, 9, 1921

The Animal Husbandry Section (*Section d'Economie des Animaux*) of the Academy of Agriculture of France requested the author to read a paper on the means of ensuring the proper feeding of young hand-reared calves without interfering with the milk supply required for human consumption or by the dairy industry. In this communication, the author describes the methods to be recommended, and which are at present in use.

Instead of feeding calves exclusively on milk, great economy can be effected by the use of various substitutes.

Of these the chief is skim milk, whether fed alone, or with the addition of suitable substances; its use promotes the consumption of farinaceous matters, grain, or similar foods. *Whey* from the cheese-factories, *hay tea*, and an *infusion of barley radicles* can also be fed, provided such nutritive and digestible substances are added as give the mixture the nutritive value of whole milk These liquids also serve to complete a ration containing farinaceous substances, grain, or seeds Calves are still reared on *mashes* consisting of various ingredients, and, finally, on suitable dry foods that are properly prepared and fed. Among the substitutes usually least known to practical agriculturists are *starch, manioca flour, rice flour, linseed, meat meal.*

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(1) See *R*, Dec, 1910, p 339, *R*, Aug, 1911, No 1231, *R*, Febr, 1913, p 173 Article by Dr P SCHUPPLI, Substitutes for Milk in rearing calves, use of an emulsion of skim milk and palm oil, *R*, Aug, 1913, article by Prof A PIROCCHI, The use of skim milk in feeding calves, *R*, April, 1914, No 359, *R*, Nov, 1914, No 1029, *R*, Dec, 1914, No 1148, *R*, March, 1915, No 309, *R*, April, 1915, No 406, *R*, May 1916, No 534, *R*, Aug 1916, No 774; *R*, May 1917, No 467, *R* Aug, 1917, No 742, *R*, April, 1918, No 446, *R*, Nov -Dec, 1919 No 1187, *R*, Jan, 1920, No 84, *R*, May, 1920, No 559, *R*, Sept, 1920, No 892, *R*, Oct, 1920, No 1013 (*Ed*)

A *diet of corrected skim milk is fed as follows:*— Giv · the calf whole milk for 15 days, then during a transition period of 8 to 10 days gradually introduce the corrected milk. If the calf takes readily to the change, a week is sufficient to accustom it to the new diet; should it suffer from diarrhoea, the mixed feeding must be continued longer. It is the task of the breeder to observe his young stock carefully, so as to know when to shorten or lenthen this transition period. The daily ration is calculated on the basis of 1 kg. of corrected milk per 6 kg. of live weight. At first, 3 meals are given, and after the 5th week only 2.

The whey from the factories where Gruyère and similar cheeses are made can be used for feeding calves. Care must be taken that it is not acid; provided the whey is fresh, it can begin to be fed from the first fortnight and given above after a fortnight of transitional feeding. Several complementary substances are added to the whey. Meat meal gives good results, as do also the flours of cereals, or crushed grain.

Hay tea is an infusion made by pouring 2 litres of boiling water on 1 kg. of good quality hay in a closed vessel. The infusion process shold last at least 6 hours if it is desired entirely to exhaust the hay; as a rule, however, it is only continued till the water becomes cold. Hay tea can also be prepared by soaking forage for about 12 hours in cold water. In this way, the water takes up twice as much nitrogenous matter as is dissolved by ordinary infusion. Although little practised this method is greatly to be recommended.

In feeding young calves reared by hand, hay-tea is most useful. It can be added to milk or mixed with flour, cooked roots, or other similar substances. As a basal liquid, it can take the place of skim millk in various preparations, or be used in addition to it.

Its use is highly to be recommended. In the region of Melun, in accordance with the advice of ROSSIGNOL, a veterinary surgeon calves have been reared on hay-tea since 1915 and 1916.

Infusion of barley-radicles. — If 15 litres of boiling water are poured on 1 kg. of barley germs, an infusion is obtained which can take the place of a daily ration of 4 to 5 litres of skim milk in feeding calves. It should be given progressively, beginning with 1 litre a day and increasing to 4 or 5 litres by the end of 1 month.

Mushes. — When all the milk of the cows is consumed, and there is no skim-milk, a liquid preparation of which the composition resembles as nearly as possible that of whole milk is fed to the calves. Amongst the different preparations used, the following may be mentioned as having yielded satisfactory results:—

Haricot Soup. — Boil the beans (*Phaseolus*) until they are quite soft, then pass them through a sieve. First use 100 gm. of beans to 2 litres of water, and increase the beans gradually, until the calf eats 0.5 kg. (divided into 2 meals) a day.

English Preparation No. 1.

Wheat flour	1	part
Linseed meal	1.5	parts
Ground linseed cake	2	parts

100 gm. in 3,5 litres of warm water to be fed per meal at first. Give 2 meals a day, and increase the amount gradually up to 200 gm.

English Preparation No. 2.

Linseed meal	2	parts
Oat meal	2	»
Ground linseed cake	1	part

Mix 500 gm. with 4 litres of hot water and leave it to infuse during the night. The following morning, take half the infusion, add sufficient water to make up about 3 litres, and also a little salt and 10 gm. of sugar Prepare the second meal in the same manner. Gradually increase the amount fed, up to 1 kg. of the mixture per day.

Ration prepared and used by Hayvard *of the Agricultural Station of Pennsylvania.*

Flour	30	parts
Coconut	25	»
Milk powder.	20	»
Linseed meal	10	»
Blood meal	2	»

Mix 250 gm. with 2 litres of hot water for one meal. Give 2 meals a day, increasing the amount progressively, as in the case of the English mixtures.

The only objection to be made to this recipe is that all the ingredients are not easily obtained on every farm.

Ration prepared and used by Linsey *at the Agricultural Station of Massachusetts.*

Ground oats	22	parts
Ground linseed cake	10	»
Maize flour	11	»
Various flours	5	»
Blood meal	1.5	»
Salt	0.5	»

The mixture is prepared by first adding a little cold water to the dry flours, followed by 6 litres of hot water per kg. of the farinaceous compounds. The amount to be given at first for each meal is 250 gm. in 3 litres of water.

All the rations mentioned should be fed warm, *i. e.*, at 35° to 38° C., and in perfectly clean vessels, the latter precaution being necessary to prevent diarrhoea.

Grain. — Amongst the cereals used in France and England for feeding hand-reared calves, oats take the first place.

Crushed or pounded oats are better than whole ones, so it appears from the experiments summarised by the author.

Experiments in feeding calves on skim-milk and oats were carried out in Ireland in 1918 and 1919 at 21 experiment centres, with a view to deciding whether it was better to add ground oats, or whole oats, to the skim milk.

Two lots of 70 calves consumed the same amount of food, the average daily increase in live weight being as follows for the 122 days the experiment lasted: —

Lot fed ground oats	0.607
» » whole »	0.597

The difference in the results is almost negligible, it was found, however, that it is difficult to accustom calves to whole oats, and that it is necessary to begin with a very small quantity (55 gm.) and to increase the amount gradually.

These experiments have also shown that the flour need not be cooked for the calves after the 5th or 6th week (average age 5 ½ weeks).

Much the same system exists in the United States as regards the use of cereals for hand-reared calves. The crushed maize and ground oats are given mixed with wheat bran according to different formulae: —

I. — 3 parts crushed maize, 1 part bran.

II. — 3 parts crushed maize, 1 part ground oats.

III. — 3 parts crushed maize, 1 part bran, 1 part ground oats, 1 part linseed meal.

IV. — 5 parts crushed maize, 1 part bran, 1 part ground oats, 1 part dried blood.

These mixtures were fed from the 2nd week, and the amount given daily increased progressively so as to reach 0.450 kg. and 0.500 kg. at the end of the 4th week. The increase is so regulated that within the 3rd month 1.5 kg. is fed per day.

IMPORTANT OBSERVATION. — When the diet includes skim milk and grain, the latter must never be mixed with the milk.

CONCLUSIONS. — Many preparations can be used as substitutes for milk in feeding hand-reared calves. Whenever skim milk can be obtained, it forms a basis which can easily be completed. Should it be unprocurable, hay tea can be used instead, or else one of the above-given recipes, the choice being determined by economy and the ease with which the ingredients can be obtained. The next point is to remember that absolute cleanliness is indispensable, not only in preparing and distributing the rations, but also in the utensils, mangers, stalls, and litter. Illness in hand-reared calves is frequently due, either directly or indirectly, to the lack of hygienic precautions.

In the discussion that followed the reading of this paper, H. SA-

GNIER mentioned that he had seen margarine used in Italy on a large scale for feeding calves as a substitute for the fat contained in skim milk.

DECHAMBRE stated that much skim milk was used in Italy; margarine and groundnut oil can be added to it, but a special apparatus is needed for making the emulsion.

Calves are reared on hay-tea in Normandy. It can be given alone, but it is better to add flour, ground oats, or linseed-meal (30 gm. per litre), or else crushed oats or linseed, which should be fed in a special manger.

415 - **Maize Stover Silage versus Maize Silage for Milk Production.** — MORRISON, E. B. HUMPHREY, G. C. and HULCE, R. S. in *Journal of Dairy Science*, Vol IV, No, 1, pp. 29-31. Baltimore, Jan. 1921.

Experiments made at Wisconsin Experimental Station, Madison, with 8 cows, producing an average of 1 ¼ lb. fat daily. They were separated into 2 equal groups, each being fed with two kinds of silage on the double reversal method for 2 periods each of 4 weeks duration with a preliminary week preceding each. The concentrate mixture used consisted of: 4 pts. ground maize + 4 pts. wheat bran + 1 pt. linseed meal + 1 pt. cottonseed meal and alfalfa hay fed at the rate of slightly less than 1 lb. of hay daily to each 100 lb. of cow weight. Each kind of silage was fed *ad libitum* twice daily. Apparently the cows consumed on an average about 5 lb. less stover silage daily per animal than of maize silage (33.25 lb. to 28.31 lb.).

Results indicated that the average daily milk production on the maize silage ration was about 3 lb. more daily per cow than on stover silage (27.4 to 24.5 lb.). A corresponding relationship existed also in the productions of butter fat (1.05 to 0.98 lb.).

Both lots lost to a certain extent in live-weight, but the difference is not great enough to be considered significant.

A comparison between the two silage rations from the financial standpoint, shows that the price at which stover silage could be figured was 61 % of the price at which maize silage was valued.

416 - **Observations and Researches on the Correlation Between the Yield in Blood, Hide, Meat, Fat, Bones, and Viscera, and the Live Weight, Sex, State of Nutrition, and Age of Cattle of the Brown Breed. in Italy.** — GIULIANI R., in *Clinica veterinaria.* Year XLIII, Nos 13-14, pp. 350-362, Nos. 15-16, pp. 410-430. Milan, July 15-30, August 15-31, 1920.

This is a contribution to the solution of the problem of how to determine, by classifiying cattle according to sex, state of nutrition and age, the average percentage of each of the products to be obtained when they are slaughtered. In order to get these averages, the observations have to be very numerous, as it is important to eliminate the factor of individuality.

The author begins by quoting other investigations similar to his own, and carried out by Messrs. LAWES and GILBERT, WOLFF, CORNEVIN, POLI, and DECHAMBRE (1). He goes on to describe the experiments made by himself at Monza using 90 animals divided into 5 classes: — (1) Manzette and heifers with 2 or 4 second incisors (20 head): (2) young steers with 2 or 4 second incisors (16 head); (3) bulls with 2 or 4 second incisors (15 head); (4) cows with at least, 6 second incisors (17 head); (5) oxen with at least 6 second incisors (22 head).

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(1) Summarised in *R.*, March, 1918, No. 321 (*Ed.*).

After giving the data, which are collected in the appended table (where the percentages refer to 100 kg. of live-weight) the author examines them comparatively, and deduces the following conclusions: —

INFLUENCE OF THE STATE OF NUTRITION. — There is a clear connection between the state of the nutrition of the animals and the percentage yield in quarters, net meat, bones, fat, head, feet, stomachs and intestines. The 1st, 2nd. and 4th increase, and the others decrease with the improvement of the condition of the animals. On the other hand, there seems to be no connection between the condition of the animals on one hand, and the percentage yield of skin, liver, spleen, kidneys, lungs, and heart, on the other.

INFLUENCE OF SEX AND OF CASTRATION. — If a comparison is made between the data referring to animals in good condition (thus excluding any effect of the state of nutrition), and of 2 to 3 years of age (thus excluding the influence of age), it is found, that: — The *yield in skin, quarters*, and the *net yield of meat* are highest in the case of bulls, intermediate in that of young steers, and lowest in " manzette " and heifers.

The *yield in bone* reaches its maximum in young steers, and is larger in bulls than in " manzette ' and heifers.

The *proportion between net meat and bone* is higher in bulls than in " manzette " and heifers; in young steers it is lower than in the first and second; this fact is connected with the greater bone development in young oxen.

The *yield in fat* is considerably larger in " manzette " and heifers than in bulls; in young steers, the fat yield is almost the same as that in " manzette " and heifers.

The percentage weight of the head and feet is slightly larger in " manzette" and heifers than in bulls; in young steers it is considerably higher than in both the above mentioned classes of animals.

The percentage weight of the stomachs (without contents), of the *intestines* (with contents), of the *lungs, heart, liver, spleen,* and *kidneys* is higher in " manzette " and heifers than in bulls; in young steers, the weight, of these parts is about the same as in bulls.

THE INFLUENCE OF THE AGE AND DEVELOPMENT OF THE ANIMALS. — If the " manzette " and heifers are compared with the cows on the one hand, and young oxen with adu.t oxen on the other (so as to do away with the effect of sex and castration), the animals in both cases being in good condition (so as to eliminate the effect of the state of nutrition), it is found that: —

Cows, as compared with " manzette " and heifers, show a decrease in the percentage weight of the skin, head, feet and stomachs; and an increase in the percentage weight of the quarters, net meat, and bones (the proportion between meat and bone is about the same as in the " man-

Yields in the Various Slaughter Products of the Brown Breed of Cattle.

		"Manzette" and heifer	Young steers	Bulls	Cows	Adult steers
% *yield in quarters* of cattle that are	thin	49.07	—	—	46.02	47.90
	fair condition .	49.80	49.97	50.18	48.12	49.78
	good condition	49.92	51.63	52.10	51.34	51.20
	fat	52.91	53.19	56.55	54.40	53.72
% *yield in net meat* of cattle that are.	thin	37.94	—	—	36.25	36.29
	fair condition .	37.98	39.05	39.02	37.21	39.01
	good condition	38.98	40.23	41.76	40.42	39.76
	fat	41.90	41.86	45.65	43.00	42.48
% *yield in bone* (excluding bones of head and feet) of cattle that are	thin	9.84	—	—	11.23	10.35
	fair condition .	10.03	9.92	9.74	9.95	9.95
	good condition	9.16	10.24	9.62	9.50	9.86
	fat	9.31	9.94	9.80	9.95	10.14
Proportion between net meat and bone in the 4 *quarters* of cattle that are	thin	3.81 : 1	—	—	3.22 : 1	3.50 : 1
	fair condition .	3.78 : 1	3.93 : 1	4.09 : 1	3.73 : 1	3.92 : 1
	good condition	4.35 : 1	3.93 : 1	4.34 : 1	4.22 : 1	4.03 : 1
	fat.	4.50 : 1	4.21 : 1	4.76 : 1	4.25 : 1	4.18 : 1
% *yield in fat* (perivisceral and perimuscular) of cattle that are	thin	2.09	—	—	1.06	2.65
	fair condition .	2.97	3.04	1.50	2.68	2.96
	good condition	3.87	3.81	2.11	3.88	4.18
	fat.	5.19	4.54	3.53	4.66	4.89
% *yield in hides* of cattle that are	thin	8.70	—	—	8.85	8.88
	fair condition.	9.38	9.03	10.18	9.55	9.36
	good condition	9.21	9.51	9.85	8.50	8.87
	fat	9.83	9.33	9.54	8.94	9.02
% *yield in head* (with horns tongue and annexed parts) of cattle that are	thin	4.30	—	—	4.29	4.10
	fair condition.	4.41	4.44	4,12	4.10	4.29
	good condition	4.19	4.53	4,03	3.99	4.06
	fat	4.02	4.32	3,73	4.03	4.00
% *yield in feet* (from the carpus and tarsus downwards) of cattle that are	thin	2.21	—	—	2.10	2.28
	fair condition.	2.13	2.33	2.07	2.03	2.29
	good condition	1.97	2.19	1.93	1.90	2.11
	fat	1.88	2.24	1.82	1.81	2.06
% *yield in stomachs* (empty) of cattle that are	thin	4.20	—	—	4.16	4.22
	fair condition.	4.25	4.14	3.89	4.30	4.20
	good condition	4.25	3.97	3.18	4.04	4.09
	fat	3.60	3.73	3.48	4.34	3.72
% *yield in intestines* (with contents) of cattle that are . .	thin	3.81	—	—	4.78	3.33
	fair condition.	4.30	4.48	3.35	5.48	3.34
	good condition	4.10	3.88	3.27	4.48	3.58
	fat	3.41	3.88	2.69	3.51	2.82
% *yield in liver* (without gall-bladder) of cattle that are .	thin	1.35	—	—	1.46	1.18
	fair condition.	1.27	1.10	1.10	1.55	1.16
	good condition	1.35	1.17	1.10	1.29	1.13
	fat	1.30	1.07	1.11	1.36	1.07

		"Manzette" and heifers	Young steers	Bulls	Cows	Adult steers
% *yield in spleen* of cattle that are	thin	0.24	—	—	0.28	0.22
	fair condition .	0.22	0.24	0.19	0.20	0.25
	good condition	0.22	0.23	0.18	0.16	0.22
	fat	0.20	0.20	0.19	0.24	0.22
% *yield in kidneys* of cattle that are	thin	0.21	—	—	0.30	0.21
	fair condition.	0.25	0.24	0.20	0.30	0.23
	good condition	0.22	0.23	0.19	0.22	0.20
	fat	0.26	0.19	0.21	0.23	0.20
% *yield in lungs* of cattle that are	thin.	0.86	—	—	1.10	0.70
	fair condition.	0.90	0.84	0.77	1.07	0.75
	good condition	0.86	0.84	0.75	0.89	0.87
	fat	0.84	0.89	0.79	0.95	0.80
% *yield in hearts* of cattle that are	thin	0.44	—	—	0.50	0.48
	fair condition	0.44	0.46	0.41	0.47	0.51
	good condition	0.46	0.45	0.40	0.49	0.45
	fat	0.42	0.41	0.44	0.54	0.47
% *yield in blood* of cattle that are	thin	3.03	—	—	3.00	3.17
	fair condition.	3.17	3.07	3.12	3.02	3.67
	good condition	2.90	2.93	2.88	3.12	2.90
	fat	2.88	3.47	2.33	2.92	3.17

zette"), whereas only negligible differences are shown in the percentage weight of the fat, lungs, heart, liver, spleen and kidneys.

In adult oxen there is, as compared with young oxen, a slight decrease in the percentage weight of the skin, quarters, net meat, and bones (the proportion between meat and bone being, however, a little higher) and the head; there is, however, a small increase in the percentage weight of fat, but the percentages of the various products show no great difference as regards young oxen and adult oxen.

THE INFLUENCE OF INDIVIDUALITY AND OF THE AMOUNT OF SOLID FOOD AND LIQUIDS INGESTED BY THE ANIMALS. — The members of the same group often show individual variation which should not be over looked. The animals that were the subjects of these experiments were slaughtered after fasting for 16 to 24 hours; in spite of this, the percentage weight of the stomachs with their contents varied between 10.82 and 26.06 % and that of the intestines between 2 and 5.32 %. These percentages will have more reason to vary if the animals have been slaughtered with their stomachs and intestines more or less full. instead of empty; and these variations would effect the percentage returns of the abattoir products. Therefore, in order to estimate the probable yield of cattle when slaughtered, it is necessary, to know whether they were fasting at the time and the length of time since they had been fed. If this cannot be ascertained directly, an approximate idea can be obtained by examining the plants and abdomen of the animal.

417 - **Sheep Breeding in Germany After the War.** — I. GOLF, A., in the *Illustrierte Landwirtschaftliche Zeitung*, Year 41, Nos. 85-86, pp. 374-376, figs. 4 Berlin, October, 1920. — II. KETTNER, in the *Deutsche Landwirtschaftliche Presse*, Year, 47, No. 9, p. 68. Berlin, January, 1920.

GOLF describes the present conditions of sheep-rearing in Germany, the measures to be taken for its development and encouragement, as well as the aim and methods of breeding to be adopted.

With the war, the economic condition of sheep-rearing improved. Forage was cultivated to a considerably larger extent, on account of the rise in wages, the agricultural worker's right to strike, and the scarcity of labour, so that most large farmers were driven to keep sheep, in order to use the supplies of forage which were two large to be consumed by the cattle, as owing to the above-mentioned reasons, there latter animals could not be kept in the same numbers as before the war.

In spite of the great shortage of shepherds, the number of sheep in Germany increased (within the frontiers of 1915), from 5 073 478 head in 1915, to 8 921 620 in 1919.

Of the average and small proprietors (according to the statistics of 1907), 51 % were, engaged in sheep-breeding, even before the war, and it is these persons (the owners of farms of less than 100 hectares) that should be encouraged and assisted to develop this industry.

According to the author, the best means of attaining this object would be to create *Syndical Sheep Farms* (Genossenschaftsschäfereien "), or more strictly *Sheep-Grazing Syndicates* (" Schafweidegenossenschaften "), such as have sprung up especially in the Provinces of Hanover and Brandenburg, and represent a method of sheep-keeping similar to but more up to date than, the *communal* system. Several proprietors unite to provide a collective flock of from 200-300 animals, and hire a shepherd, who is partly paid for his services, but may be allowed to share in the profits, or even keep a certain number of sheep himself, as is generally the practice in communal sheep-farms.

During the winter, each owner takes back his animals, the flock being made up afresh in the spring.

According to KETTNER, such Sheep-Grazing Syndicates have recently been formed in Silesia, and are the first of the kind in all West Germany. These Syndicates propose to keep their sheep (which are of the improved Wurtemberg breed) in the open, night and day, in order not to lessen their resistance to cold and disease. The Syndicates are Joint Stock Limited Liability Companies based on the following regulations :—

(1) For each animal the owner pays the sum of 10 *marks*, and caution-money amounting to 20 *marks*.

(2) The object of the syndicate is the improvement and development of sheep-breeding by the following means :—

(*a*) The engagement of a common shepherd.

(*b*) The acquisition of good animals for breeding and especially of the services of a first-class ram.

(*c*) Increasing the pasturage by making and renting grazing-grounds.

(*d*) The collection and common use of the subsidies granted by the Chambers of Agriculture, or other Agricultural Corporations.

(*e*) The co-operative sale of wool and other products.

(3) Any person can become a member, who undertakes to pay his assessed share of the expenses.

(4) Sheep-owners, who for good reasons, are unable to join the syndicate, can obtain grazing-rights by paying a certain reasonable sum.

As regards the objects aimed at in breeding, GOLF states that, at the present time, there is a marked tendency among breeders to raise dual-purpose sheep, that is to say, animals combining the highest possible wool yield, with mutton production, as such sheep are by far the most profitable.

The author divides into 4 classes the different methods of breeding, and the various races that are of value for the improvement of sheep-breeding in Germany: —

(1) Silky merinos, producing:
  (*a*) carding-wool and wool for woollen stuffs.
  (*b*) combing-wool, extra-fine, fine (AA-A).
(2) Early-maturity Merinos (merinofleischschaf) and Anglo-Merinos.
(3) Early-maturity varieties (black-faced) sheep (Schwarzköpfide Fleischschafe) of English origin.
(4) Local breeds.

The breeds in which sheep-rearers are at present most interested are the *early-maturity Merinos*, and the *local breeds*. The former are much valued on account of the satisfactory weight of their unwashed fleece (Schurgewicht), their long, soft (fineness A B) combing-wool, their early maturity, symmetry, and thriftiness, as well as for their excellent constitution. The local breeds are chiefly suited to the small or average farm where the owner takes up sheep-rearing without having had any prevoius experience in breeding. The *Dishley Merinos* and *Meleschaf* breeds are much liked ad widely kept for the sake of their extraordinary early maturity and their fattening capacity, as are early black-faced varieties of English origin, such as Shropshires, Hampshires, Oxfordshires and Suffolks which are also noted for the production of fat lambs (either pure-bred animals, or hybrids resulting from the cross black-faced ram Merino, but their wool is inferior, both as regards quantity and quality. This defect is very remarkable, seeing, that wool production is the most important factor at the present day. The former sheep only yield wool of quality B or B-C (intermediate or intermediate ordinary) and the wool of the latter is only grade C (ordinary quality).

As for the *silky Merinos*, their number is constantly declining and it is only in the Provinces east of the Elbe, that they form any considerable part of the total number of sheep. The author draws attention to the fact that they are good wool producing animals which is a matter of great importance, seeing that the increasing importation of foreign wool will particularly affect the sale of the ordinary local products

In conclusion, the author touches upon the necessity of a certain uniformity in the breeding-methods adopted in the larger regions. He advocates the institution of a National Sheep-Breeding Society, (Landesschafzucht) and the establishment, by the members, of Cooperative Wool-Collecting Centres (Bezirkssammrestellen) in the various States. These measures would insure an abundant supply of even-quality wool, and would provide the owners of small and average-size sheep-farms with a good market for their produce.

418 - **Sheep and Goat-Breeding and the Skin Trade in Brazil.** — Guedes M in *Chacaras e Quintaes*, Year XII, No. 1 pp. 29 30, fig. 1 São Paulo, January 15, 1921.

Brazil possess vast tracts of land eminently suitable for grazing-grounds. One of these is the zone of over 1 million sq km. extending from the State of Bahia over the greater part of Maranhão. It appears that sheep and goats do best in the southern part of this region

The sheep of the northern portion, which were introduced at the time of the discovery of the country have hardly any wool, and the little they produce is not used industrially. Goat-breeding is, however, a matter of considerable importance; it is generally practised by small proprietors, and needs but little attention. The herd is sent out in the morning to graze, and the animals, find there own way back in the evening to the folds. The skins of these goats are of excellent quality. They are not salted, but are soaked in a preserving solution, and dried in the sun They generally go through two intermediate stages before being sold to the exporting firms.

According to the latest available statistics, the number of goat-skins and fleeces exported from Brazil in 1919 were as follows:—

Goat-Skins and Fleeces Exported from Brazil in 1919.

	Quantity in kg	Value in *milreis*
Pará	161 423	593 819
Maranhão	16 425	54 751
Ilha do Cajueiro	16 425	342 172
Fortaleza	1 139 273	12 017 180
Natal	88 148	1 035 542
Cabedello	281 791	3 142 745
Recife	968 761	10 114 253
Maceió	64 226	586 587
Bahia	1 951 185	19 988 715
Rio de Janeiro	210 342	2 216 344
Other ports	244 974	984 925
Totales	**5 165 840**	**51 077 015**

Most of these figures refer to goat-skins, sheep-fleeces being exported in smaller numbers. Hides are also exported (in 1917 190 184 kg. of the value of 620 386 *milreis*). The author estimates that the production and exportation of hides from Brazil could easily be increased tenfold. He states that it pays better to export hides than leather of which equally large amounts are produced in Brazil.

419 - **Feeding and Weight of Young Pigs of the Large White Breed in Italy.** — GIULIANI, R. (Director of the Zootechnical Station of Latium, Rome), in *Il Coltivatore*, Year LXVI, No. 36, pp. 973-975. Casale Monferrato, December 30, 1920.

With a view to determining the connection between increase in weight and food consumption in the Large White Yorkshire breed of pigs, the author ascertained for 64 days from the time of weaning, the increase in weight of a farrow of young Yorkshire pigs, which consisted of 6 males and 6 females. The data obtained are given in the appended tables.

Increase in Weight.

		Males	Females
Total initial weight	kg	110 600	107.800
Total final weight	»	206 000	209.200
Total increase in weight in 64 days	»	95.400	101 400
Average increase in weight per head per day	»	0.248	0 264

Total Amount of Food Consumed by the 12 pigs in 46 days.

	Weight in kg.	Starch value
Wheat shorts	860	387
Maize flour	82	66
Barley meal	24	16
Beets	640	40
Lucerne	242	21
	—	530

Thus, with a consumption of food amounting to 530 starch units, an increase of 196.8 kg. in live-weight was obtained, that is, 269 starch values would be necessary to produce an increase of 100 kg. in live weight.

420 - **Experiments on the Feeding of Hens with Rations without Grain.** — WINNINGER, G., in the *Deutsche Landwirtschaftliche Geflügelzeitung*, Year XXIII, No. 18, pp. 497-498. Berlin, Feb, 1921.

I. — RATIONS WITHOUT GRAIN. — For a whole year 100 Italian hens (hens and pullets 2 years old) were fed on rations which contained no grain. The daily ration was 10 gm. of bone flour, 40 gm. lucerne, 30 gm. weeds, 20 gm. kitchen offal and 30 gm. sorb-apples. These materials were covered with boiling water and given as a mash on the next day. The hens were allowed to run free. It was found that 62 hens continued to lay, but the production showed a decrease of 56 % as compared with the preceding year, when the production was 120 eggs. After at least 30 gm. of grain had been added to the ration for 3 weeks, laying became normal. A second test with 50 hens gave the same result, and production was never more than 6-8 eggs day. Chemical analysis showed that the lack of grain had no remarkable effect upon the composition of the eggs ; it was observed, however, that the amount of vitamine was less.

II. — RATIONS IN WHICH ANIMAL SUBSTANCES WERE SUBSTITUTED FOR GRAIN. — As grain is relatively rich in vitamines, the author attemted to replace them by food of animal origin which contained a relatively large quantity of amides. The 19 hens experimented with, laid 4-5 eggs a day when the grainless ration was given, but the production increased as the quantity of meat meal was increased.

When the quantity of meat meal was increased from 10-60 gm. during the period Feb. 1-July 21 the egg production increased as follows :

10	gm. of meat	flour	per day	6	eggs.
20	»	»	»	10	»
30	»	»	»	13	»
35	»	»	»	14	»
40	»	»	»	15	»
50	»	»	»	15	»
60	»	»	»	18	»

The total production during this period was 1368 eggs, giving an average of 72 eggs per hen in 172 days. The maximum daily production was attained during the period March 31-April 18, with 60 gm. of meat flour, the production being 345 eggs, an average of 18 eggs. In addition, during this period, 12 hens each laid 2 eggs, so that one hen therefore produced 35 eggs during April. The author considers that this result was due to the meat meal.

In summarising the results of his experiments, the author remarks that even though the grain can be replaced by fairly large amounts of meat meal the best results would be obtained with rations containing 30 gm. of grain and 15-205 gm. of meat meal.

421* - **The Hemipteron *Lyryocoris campestris*, a New Parasite of the Silkworm recorded in Italy.** — *L'Italia vinicola ed agraria*, Year XI, No. 12, p. 188. Casalmonferrato, March 20, 1921.

In 1920, on several silkworm farms at Tezze di San Dona di Piave (Province of Venice) the recently-hatched larvae were attacked by an insect which Prof. CORTI, of the University of Bologna, has identified as the hemipteron *Lyrtocoris campestris* Torh., which lives on poplar trunks, under fallen leaves, etc.

This insect rapidly and repeatedly pierces the worm in the inferior lateral regions. The worm at first reacts with violent movements and then dies. The habits of this hemipteron are now being inquired into and means of control are being investigated.

422 - **The Intensive Culture of Carp at Morimondo (District of Abiategrasso, Province of Milan).**

— Tagliabue, C., in the *Bollettino della Società Lombarda per la Pesca e l'Acquicoltura*, Year XIV, Nos. 1-2, pp. 11-13., Milan, Jan.-Feb., 1921.

The land chosen for breeding Galician mirror-carp was in the centre of a rice field, and was divided into three plots of a total area of about 1000 sq. metres ; it was sown as meadow land and kept dry.

The following operations were carried out :—

May 2 1920 — Mowing of herbage that had grown in the dry ponds.
» 6 » — Filling of the ponds with water and immersion of the parents (1 female and 2 males per pond).
» 8 » — Spawning of the carp.
» 9 » — Removal of the adults.
» 14 » — Fry hatch out.
» 15-17 1920 — Fry were removed (about 60 000) and put to grow among the rice plants.

The temperature of the water in the ponds on the day before spawning was :—

18° C. at 6 a. m.	28° C. at 2 p. m.
20° C. » 8 »	28° C. » 4 »
22° C. » 10 »	27° C. » 6 »
26° C. » 12 »	24° C. » 8 »

On June 9, the ponds were completely drained and about 10 000 young carp, 2-3 cm. long, were removed and placed in other rice fields. Of this number 2.000 were preserved in fishponds, the intention being to put them back later into the same ponds after they had been refilled with water. At the same time the rice had been transplanted in the spawning ponds at intervals of 15 cm. along and 20 cm. between the lines.

The 2 000 young carp were fed successively with specially cooked cakes of maize flour, rice residues, blood meal, Canadian elodea, calcium carbonate, calcium phosphate and molasses.

The total amount distributed was :—

42 kg. of maize flour	at *lire*	0.80	per kg. =	33.60 *lire*
37 » rice husk	» »	0.30	»	11.10 »
30 » small rice	» »	0.60	»	18,00 »
8 » blood meal	» »	1.00	»	8.00
35 » Canadian elodium	» »	0.05	»	1.75 »
2 » calcium carbonate	» »	0.45	»	0.90 »
2 » calcium phosphate	» »	6.00	»	12.00 »
4 » molasses	» »	2.65	»	10.60 »
				95.95 *lire*

Cost of cooking: 75 kg. of wood at 0.18 *lire* per kg	13.15 *lire*
Manual labour carried out by children	20.00 »
Value of young carp when immersed	10.00 »
	139.10 »

1374 young carp, year old, total weight 40 kg. (average of each 29.5 gm) at 20 *lire* per 100	274.80 *lire*
less expenses	139 10 »
	135,70 »

Net profit 1357 *lire* per hectare.
Gross receipts from marketable fish:

40 kg. of young carp at 6 *lire* per kg.	240.00 *lire*
less total cost	139.10 »
Net profit	**100.90** »

or 1009 *lire* per hectare.

In this account the value of the young carp born in the ponds and afterwards put in the rice fields has been neglected, nor has the value of the rice crop, which was, in proportion, superior to that of the neighbouring rice fields, been included.

There are many other kinds of produce which may be used for feeding fish, such as lupin flour, crushed maize stalks, etc. Carp can also be given slaughter-house blood, either fresh or lightly cooked on a water-bath. Also numerous insects which abound in the soil and in stagnant water such as the worms found in rich soil, or planorbis or limnæa, which can easily be found in the rice-fields. By this means artificial feeding can be reduced and even completely eliminated.

423 - **Rainbow Trout in the Small Lakes of the Emilian Apennines** — *Rassegna di Pesca*, No 1-4, p. 120; *Bollettino della Società Lombarda per la Pesca e l'Acquicoltura*, Year XIII, No. 9, pp. 92-94 Milan, Sept., 1920

The rainbow trout (*Salmo irideus*) was introduced into Italian waters several years ago; it combines the advantage of rapid growth with that of remarkable vigour. It is the latter quality which enables it to live in warmer and more troubled waters than those where the native river trout (*Salmo fario*) are found. It was formerly believed that the habits of the rainbow trout were different from those of *S. fario*; that is why the fry were placed in rivers whose higher average temperature and less clear water were not suited to the native trout.

The idea that it was best to rear native trout in clear, cold waters and the rainbow in warm, and often muddy waters was abandoned when it was found that this trout did very well in the clear and cold waters of certain small lakes. PAOLUCCI announced, in 1915, that the rainbow trout was quite well acclimatised to the water of Lake Moncenisio, which lies at an altitude of 2 000 metres.

Some time later (*Annali di Idrobiologia e di Pesca*, vol. I, 1918), he published an account of the excellent results which he had obtained with the rainbow trout in some of the small lakes of the Emilian Apennines, *i. e.*, lakes Santo and Gemelli, or Lagni, situated, respectively, at 1 507 and more than 1 320 metres of altitude, lakes that freeze in the winter from a minimum of 3 to a maximum of 6 or 7 months. Not only has the rainbow trout become acclimatised but it is has reproduced in Lake Calamone (Reggian Apennines), situated at an altitude of 1407 metres, but which does not freeze because it is fed by springs.

The first *Salmo irideus* fry were put into this lake by the Piscicultural Station of Castelnuovo Monti on April 30, 1911. In the summer of 1918, adult trout weighing 0.5-1.5 kg. and also young trout 10-12 cm. long were caught; the latter were evidently born during the spring of the preceding year. This example, which appears to be the first of its kind in Italy, shows that it is quite possible to stock many of the small Apennine lakes, which are now quite void of fish.

FARM ENGINEERING

424 - **The Economic Advantages of Mechanical Ploughing** (1). — SCHWANECKE, H. Die Kraftpflüge und ihre Betriebskosten, in the *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 36, No 6, pp 90-97. Berlin, Feb. 5, 1921. — II. AMBROSINI, I., In tema di costo di aratura, in the *Giornale di Agricoltura della Domenica*, Year 31, No. 8, p. 58. Piacenza, Febr. 20, 1921. — III. GIRARD, H., Frais comparé des chevaux, des bœufs et des tracteurs, in the *Journal d'Agriculture pratique*, Year 84, Vol. I, No. 14, p. 236. Paris, April, 1920. — IV. BEGLINGER H., Entwicklung und Stand des Motorpflugwesens in der Schweiz, in the *Landwirtschaftliches Jahrbuch der Schweiz*, Year 34. No. 3, pp. 210-243 + 22 figs. + 3 plates. Lucerne, 1920. — V. LARUE, P., Notes de motoculture, in *La Vie agricole et rurale*, Year 10, Vol. XVIII, No. 9, p. 136. Paris, Feb. 28, 1921. — VI. HUFFEL, G., Emploi de tracteurs à chenilles dans les exploitations forestières, in the *Revue des Eaux et Forêts*, Vol. 59, No. 2, p. 40. Paris, Feb. 1, 1921.

I. — MECHANICAL PLOUGHS AND COST OF WORKING. — The question as to the economic advantage of mechanical over animal-drawn ploughs has been asked for several years now.

In 1908, Germany had 4 or 5 works making FOWLER ploughing sets but of the 478 machines then existing in Prussia, 67 % were of British manufacture, and generally had a locomotive of 16HP nominal. In Germany, the FOWLER steam ploughing sets were used on less than 0,12 % of the farms of less than 100 hectares in area, on 8.6 % of farms of 100-400 hectares and on 32.6 % of the farms of over 1000 hectares Electric ploughing is still little known, but internal-combustion motor ploughs are well known, being rope drawn, or by direct or indirect traction. These in turn gave place to automobile ploughs (" Tragpflüge ") and to tractors. Germany has mostly turned out direct-traction ploughs because, out of the 3 or 5 types of windlass ploughs, only one has proved at all popular. There are 14 or 15 types of motorploughs and about

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(1) See *R.*, Feb. 1920., No. 244. (*Ed.*)

20 types of tractors, the latter being preferred nowadays. During the war, chain-track tractors have become perfected and made of practical use; there are 3 or 4 types of these in Germany. The replacement of the share and mould-board by a rotary apparatus has been tried. Since the war, light tractors, of 4HP or even less, have mostly been built, as they are useful in many ways; these machines are coming into vogue in America, as was seen at the Agricultural Week show held at Chartres in October, 1920. MEYENBURG reports tha. in America, 116 firms are building about 120 types of tractor, or about 170 different machines, taking account of the various sizes, and the number is still increasing. The perfect ploughing machine, however, has not yet been invented, if ever it will be.

It is impossible to say, under the present state of agricultural science and practice, what is the best, simplest, and cheapest way of ploughing, at any rate as regards Germany and Central Europe.

Apart from the question as to whether the present system of ploughing is the best, it is, at present, only possible to discuss the relative values of the different types. The plough share may be compared with the rotary-tillage machine, or with the cable-drawn, steam, internal combustion, or electrically driven ploughs of various sizes. Whether the ancient plough-share should be replaced by the modern rotary machine is not yet clear. If the soil is light and not stony, the rotary machine gives good service in breaking up hard land; again for peat and pasture land it seems the best and fastest implement, but it is not suited to stony, heavy, mineral soils. According to the author the best machine of this type to day is the " Landbaumotor " LANZ-KÖSZEGI Agricultural Motor which weighs 5 500 kg., and has a 4 cylinder 80 HP. engine. It can plough 4-8 hectares per day with a consumption of 150-180 kg. of benzine. This machine, with the plough removed, can be used as a tractor.

The MEYENBURG electric plough may become the true small plough, the chief tool of market and other gardeners.

The funicular or rope drawn plough is better than the direct traction plough, because it runs over but a small area of the field, and does not move away during ploughing; it is, above all others, independant of weather and soil conditions, it is faster and less liable to breakages. The disadvantages are the high price, due to its limited use, and the fact that the factories prefer to make heavy machine, the great weight and the need for more attention. For small farms, progress needs to be made with the single motor system.

The question of the type of driving power best suited to ploughing is very interesting. Electricity has many advantages, but is very costly, and the electric plough is still imperfect, but it should make great strides, especially as regards small ploughs provided with rotary members.

The author, after consideration of the pros and cons of steam ploughs, concludes in their favour. Internal combustion engined ploughs are not as suitable as steam ploughs chiefly because of the dirt they gather and the wear they suffer during ploughing. Again the fuel and oil is not always easily available and is not pure enough for perfect working, a most important point as regards the explosion engine (1).

Again, difficulties with the cooling system, magneto, and sparking plugs, and extreme wear of certain parts are all absent in the steam engine, so that the choice of a driver for a motor plough is of the greatest importance. According to REZEK, the fuel consumption of motor ploughs varies little per hour, whereas that per unit area may vary greatly, even with careful handling. Moreover, although machines of the same make and power will cover approximately the same area (*e. g.*, STOCK and KOMNICK) ploughed under equal conditions and in soils of average resistance (*e. g.*, 30-34 kg. per sq. dm.), they behave very differently in very light or very heavy soils, which is the reason for the very diverse opinions of practical men.

With regard to the dimensions of the machines the author thinks that steam engines of 12-14 nominal H.P. are the most economical, for average-sized farms, and 100-120 H.P. engines for hire. He estimates that the economy of using motor-ploughs of less than 20-25 H.P. (2) is doubtful, and if one favours a motor plough he advises, for large farms, not the machine of 100 H.P. or more, but several average machines of 50-60 H.P.

As for the quality of the work, the cable-drawn plough gives perfect results, even better than animal drawn ploughs Tractor and motor ploughs are correspondingly inferior to animal haulage.

The influence of mechanical ploughing on crop yield, and on the number of men and animals employed varies in each case.

The author concludes that in farms where motor ploughs are used, the elimination of an equivalent number of draught animals especially horses, occurs much more rarely than in farms that employ steam ploughs (3). The author analyses the capital invested and the cost of working, and concludes that, in 1907-1913, the daily cost of a two-horse team, driver included, could be taken at an average of 12 *marks*, so that the total cost of covering (hectare of sown land (average soil), under, normal conditions 16-22 cm. deep) cost 27 marks and ploughing under similar conditions 35-40 cm. deep cost 50 *marks* or more. The steam engine under the same conditions cost 13-25 and 18-40 *marks*, respectively (15-22 *marks* with the big machine used for 100 working days per year). In 1913, a 40 H.P. motorplough cost about 17 *marks* per hectare at a depth of 20 cm., and 20 *marks* at 30 cm. deep. If, in spite of all its faults, the mechanical plough was economical in use before the war, now it should be all the more so. The author quotes data to illustrate this regarding a 400-hectare farm with different systems of cultivation and ploughing, and shows that, in Germany, the present cost of animal ploughing of 1 hectare, at 16-22 cm. deep in average soil, is 300 *marks*, and at 35-40 cm. is 520 *marks*, whilst under normal conditions, ploughing mechanically 16-22 cm. deep entails the following cost:—

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(1) The high price of benzine, paraffin, and heavy oils has suggested the use of poor gas for motor-cultivators. See *Journal d'Agriculture pratique*. Year 84, Vol. I, Nos 15 and 18. (*Ed.*)

(2) Recent motor shows mark the tendency, according to DUVAL, to increase the angular speed and the power; nowadays the average power is 30-40 B H. P. See the *Journal d'Agriculture pratique*, l. c., No. 6, p. 112. (*Ed*)

(3) An enquiry made in Pennsylvania showed that 57 % of the farmers had done away with their horses and that a tractor, working a constant area, replaced 4 horses. See *U. S. Department of Agriculture, Farmers' Bulletin* 1035, p. 32. Washington, 1919. (*Ed.*)

275-280 *marks* with tractors and motor-ploughs.
250 *marks* with cable-drawn ploughs (2 engines).
180 *marks* with twin-engined steam ploughs.

These results vary greatly with change of conditions.

CONCLUSIONS. — 1) All the mechanical ploughs examined with reregard to working cost are superior to animal ploughs. However, as regards safe working and good work the cable-drawn set can at least be put on a par with animal ploughing.

2) The steam ploughing set is to-day decidedly superior to the other types of mechanical plough, not only because of its safety, but especially for its cheapness, for it does not matter how small the field or how badly situated, as long as the machine is worked at least 30 days in the year. As the cost of a set is very great, it would be a great advantage to let one out on hire,or run it on co-operative lines.

II. — IS MOTOR-CULTIVATION STILL ADVANTAGEOUS? — The variations which have taken place lately in the price of animals and fuel have brought up this question again in certain parts of Italy (1). The author gives an example from the province of Piacenza.

Farm 80 hectares, in area, soil compact; during 9 years the rotation was:— 1) Maize; 2) wheat; 3) 4), 5) lucerne; 6) beet; 7) wheat; 8) trefoil; 9) wheat.

(a) *Before the introduction of the tractor*, the animals kept were, 12 draught oxen, 30 milch cows, 30 stock cattle and 8 horses.

(b) *After the introduction of the tractor:* 4 oxen, 38 cows, 30 stock cattle, and 8 horses.

When examining the variation under (*a*) and (*b*) the author took into account the interest on capital, cost of amortisation, accidents, repairs, etc., food and fuel, manual-labour and numerous other factors and he concluded that *the advantage of using a tractor is still considerable*, and as the advantage is so marked it can be presumed that some advantage will always remain to the tractor, provided no fundamental differences occur, even when allowance is made for the good will of the workers, for the fact that the tractor enables the best time to be chosen for the work, and is independent of epizootic diseases, strikes, drought, and the round of hired machines. It is for this last reason that the farmer prefers to buy his own tractor even where steam ploughing sets can be hired, in spite of all its advantages.

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(1) In France also, there is almost a crisis in motor-cultivation, owing to the excessive price of benzine. See *Le phosphate et les engrais chimiques*, Year 30, No. 1326, p. 69. Paris, Feb., 1921. (*Ed.*)

III. — COMPARATIVE COST OF HORSES, OXEN, AND TRACTORS. — The author has taken into account in this calculation the cost of fodder, amortisation, cost of shoeing, wear of harness, interest on capital, unforseen occurrences, etc. and deduces a cost of 25 fr. per day per horse and 16 fr. per ox.

A tractor costing 21 000 fr. amortisable in 3 years, which works 150 days a year, costs 260 fr. daily. Therefore the cost of ploughing 1 hectare of land 20 cm. deep at the beginning of 1920 at Bertrandfosse. France, was :—

187.50 fr. with a 3—horse team
192.00 fr. » » 4—horse »
173.00 fr. » » tractor.

The author has come to the conclusion that, inspite of the disadvantages of the tractor, its mechanical kilogrammetric economy compared with the work of the animal motor is clearly established (1).

IV. — THE DEVELOPMENT AND SITUATION OF MOTOR-PLOUGHING IN SWITZERLAND. — The author (late chief of " motolabour an Commissariat pour la culture des places d'armes suisses pendant la guerre) places the appearance of the first motor-mower in Switzerland in 1913-1914. Towards 1916 the first tractor, the Mogul appeared, whilst the second, the Moline, appeared in the spring of 1917.

The first motor-plough test took place at Witzwil, near Berne, on Feb. 14-16, 1918. To-day there are several types in use in Switzerland, both of foreign and national make, but on account of the extent to which local property is divided, small 4-cylinder 16-20 H.P. tractors are preferred.

The first swiss tractor was built by SAUER of Arbon, whilst the firm of OTT built the plough. The combination, made its first appearance at Witzwil.

The author also reported on the constructional School and the tests used. It will be sufficient to describe a few tests on drainage and ploughing with turn-wrest ploughs.

For drainage a SCHEUZER chain-track tractor was used, drawing a ditcher or " *autodrainneuse* ". Engine 45 H.P., speed 4 km. per hour ; weight 6000 kg., width of ditches 35, 50, 80 cm. maximum depth 2.30 metres ; digging capacity 50-70 metres per hour at 1.5 metres deep. The ground was marshy, and after ditching, the tractor ploughed the same land. This tractor, according to the author is the only one capable of breaking up the land of the Rhône plains.

In the summer of 1919, an international competition was held, under the patronage of the Division d'Agriculture, at which a prize of 5 000 fr. was offered for a turn wrest tractor plough capable of digging at least two furrows at once. The official competition was held on March 25,

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(1) The Pennsylvanian enquiries (see preceding note) showed that a tractor had a life of 9 years, and that the cost per day fell to 63.34 fr., and the cost per hectare exclusive of the wear of the plough, was 30 fr. See the continuation of this article. (*Ed.*)

1920 at Valentin, near Yverdon, between the only two double mould-board Swiss ploughs (OTTO and VOGEL). French and German firms were unable to send their machines on account of transport difficulties.

The tests were successful, but further progress is still required. These double mould-board ploughs which can be drawn by tractors, are a necessity for small holdings, for work on hill slopes (1), and for ridging. The author thinks that a balance plough could be tried, partly pushed and partly drawn by the tractor.

The author gives the list of motors used by the Commissariat Suisse during the war, together with their characteristics. He has calculated the cost of mechanical ploughing but states that it is impossible to carry out a proper scheme or to obtain accurate results with short and hasty tests. He cites all the factors on which he judged the cost of working animal and mechanical motors, and gives the following Table which shows the cost of working of each make of tractor used by the Commisariat, including the cost of repairs, salaries, depreciation, etc.

	Fuel Consumption Litres per hectare	Working Cost Fr. per hectare
I. — *Berna Tractor* Hired out in 1918-1919 at 30-50 frs per day		
a) Long road distances, ground moist, little adhesion, small areas	57.64	133.25
b) Peaty soil; wheels slipped	52.22	125 00
c) Good soil; engine running badly	50.70	126 40
d) Valley, old meadow, very damp- small plots	63 90	176.40
e) Tenaceous stubble; grip and time very good	61 64	150.00
I. — *Berna Tractor* used on military land at Frauenfeld		
a) Good soil	41.66	99.70
b) Light soil 600 metre forrows	33.61	86.95
II. — *Case Tractor:* Good soil, high costs and wages: 17-21 hectares	53.90	92.50
Harrowing 17-24 hectares	—	11.50
III. — *Case Tractor:* 2 repairs every 30 hectares.	34.20	97 20
IV. — *Avery Tractor:* (paraffin-benzine mixture) Large plots grip and time good; 15 hectares	32.50	82.80

V. — NOTES ON MOTOR-CULTIVATION. — The author gives the results of the enquiry made by NICHOLLS amongst 320 American farmers.

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(1) The question of the transverse ploughing of hill slopes is very important in hilly countries. Good results on moderate slopes were obtained at Basilicata (Italy) with a Melotte trifurrow turn-Wrest plough and Titan tractor. (*Ed.*)

The tractor was stated to be an advantage in 71 % of the farms of an average area of 200 hectares, but not on 70-hectare farms. The tractor lasted 7 years and replaced 2-10 draught animals. The plough recommended the most was a tri-furrow one.

ZIMMERMANN is against a greater speed than 5 km. per hour. A tri-furrow plough should plough 1 hectare of compact soil in 2 $^3/_4$ hours, and mellow land in half that time. If the land is mellow, especially if it is damp, animal haulage is better. Tests made at Grieshof, with an electrical tillage machine, show that to plough 1 hectare, 8-11, 19-22, or 22-25 cm. deep takes respectively a current of 47, 86, or 98 kilowatts; an average according to WERNER of 56 kw.-hrs. If the dynamo is driven on benzine it consumes 20-30 kg. of fuel per hour, nearly as much as a motor-plough. Electricity is more useful than economical.

VI. USE OF CHAIN-TRACK TRACTORS IN FORESTRY. — A communication concerning the RENAULT chaintrack tractor used in experiments made in November, 1920, on the Lower Rhine.

This tractor was used for hauling logs and also for felling. It could haul, over ordinary soil, 3 pine trunks with a total volume of 4-5 cubic metres, although HUFFEL thinks that with the aid of a log-truck it could haul double that amount. After two or three attempts the tractor felled pines which were over 120 years old and 40-45 cm. in diameter. In one hour it felled 10 cubic metres of timber, whilst it takes two practised cutters 10 hours to cut 1 cu. m. The author cannot recommend tractors for drawing stumps, felling deciduous trees or felling trees over 40 cm. in diameter (1).

The author concludes that the utility of the tractor in forestry depend on the following conditions: —

1) Skill of auxiliary personnel.
2) Concentrated and important forestry enterprise.
3) Felling coniferous trees.
4) Animal haulage costing more than 15-25 fr. per cubic metre, and necessitating high wood-cutters wages.

425 - **Substitution of Vegetable Oil for Paraffin as Fuel for Motors and Tractors in the Colonies.** — LEPLAE, E. (Directeur General de l'Agriculture au Ministère des Colonies de Belgique), in *La Nature*, No. 2436, pp. 374-378 + 5 figs. Paris, Dec. 1920.

It is very difficult and costly to transport American or Asiatic petrol into the interior of certain tropical countries. All goods must be carried by native porters, as animals cannot be used because of diseases transmitted by insects such as tsetse flies, etc. But native porters are also expensive and because of these reasons it is advisable to replace them by mechanical transport if a good, cheap, fuel can be found in the country.

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(1) In experiments made in France, at La Motte Beuvron on June 9, 1920, a 35 H.P. chain-track tractor pulled up stumps 30 cm. in diameter with their roots in 2 minutes, and FLORENT, who reported this, thinks that this time can be cut down by half. He says that the use of explosives and tractor combined should be able to remove the stumps and roots of the biggest size. (See *Journal d'Agriculture pratique*, Year 84, Vol. I, No. 26, p. 489. Paris, June 24, 1920). (*Ed.*)

In October 1919, the author proposed that the Belgian Colonial Ministry should organise a trial of road tractors using palm oil as fuel. This was done in July, 1921, and not in 1920 as was first announced.

But trials directed by an engineer, MATHOT, have already been carried out using palm and cotton oils, in England and Holland. MATHOT carried out complete trials, determined the fuel consumption, and drew up many diagrams. A detailed report will eventually be published when certain experiments that are still taking place have been finished.

The results obtained have opened up vast prospects of the development of central Africa and other colonies. They can be summarised as follows: —

1) Palm oil like cotton oil, when used as sole fuel in semi-Diesel, 2 or 4 cycle engines, gave full satisfaction. The engines ran normally, and the power developed is equal to, if not greater, than that obtained with kerosene. The fuel consumption, at full load, of 15-25 HP. motors tested over 12-15 hour runs, varies between 262-230 grammes per effective HP. hour.

2) Nothing was noted that suggested possible difficulties in using palm oil in semi-Diesel engines. The diagrams are normal. Starting up, without petrol injection, is good, there is no carbonisation, the exhaust gases are clearer than when paraffin is used. Water injection is neither necessary nor desirable. All that is required is to melt the oil by placing it near the exhaust, or running the feed pipe in a coil inside the exhaust.

La Société Belgo-Americaine "La Forminière", (which holds diamond and rubber concessions) possess 3 tractors that run on palm oil and have just ordered 2 more. This oil is also being used at a wireless station in the Belgian Congo.

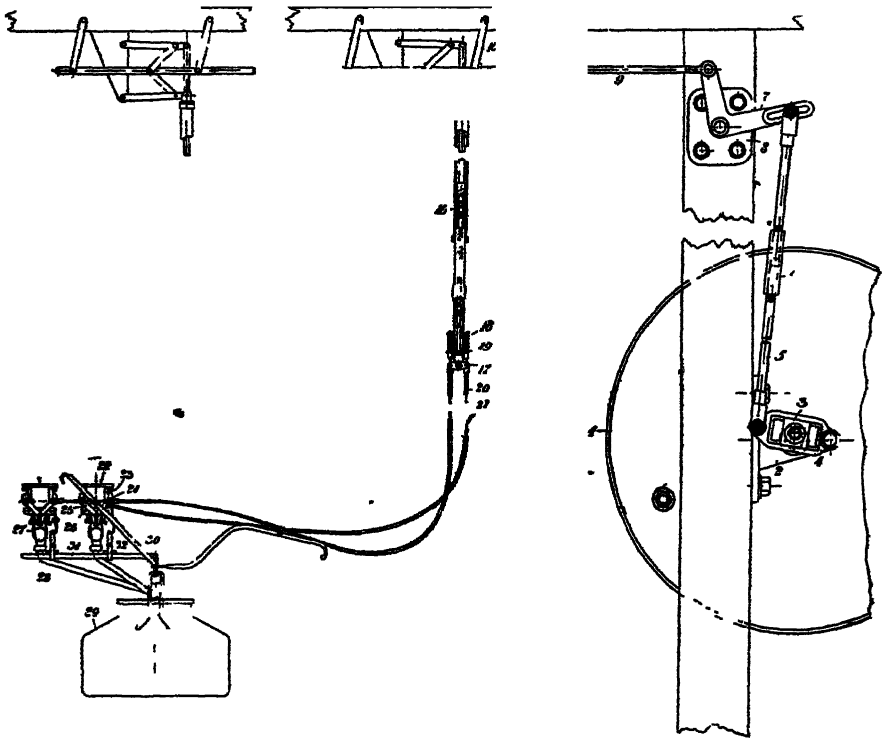
Semi-Diesel engines tested in Belgium in 1919 gave the same good results. A Swedish engine, the DROTT, was tested at Brussels some time ago in the presence of RENKIN, former Minister of the Colonies.

The semi-Diesel engine, is very suitable for propelling boats, locomotives, tractors, and fixed machinery, and is of great practical utility for colonial use. Machines will probably soon be available which in normal times will not cost more than 5-10 centimes for fuel per effective HP. hour.

It is thus evident that vegetable oils, so varied, abundant, and cheap in the tropics, can replace paraffin as a fuel for semi-Diesel engines.

426 - **The Hägg Milking Plant.** — *The Implement and Machinery Review*, Vol. 46, No. 548 p. 1222. London, December 1, 1920.

A description of a Swedish invention which approaches as nearly as possible the ideal standard of mechanical milking. No vacuum, water or air, and consequently no pumps, diaphragms, conduits and suction pipes are used, and the costs of erection and running are therefore on a minimum basis. The HÄGG works silently and gently and produces clean milk, and has a special regulating device which fits automatically to any size of teat. All parts are visible and accessible, and the teat cover is easily removed and another substituted if necessary. No lubricating is required, and an outfit for 50 cows can be driven by a ½ h. p. engine. On the other hand, the apparatus can be driven by hand, and is not beyond the power ordinarily exerted by a boy.



The plant consists of two principal sections, together with a primemover. One section is composed of a pulley with slides and an overhead shafting with couplings; the other comprises the milking device itself with the necessary hand couplings. The pulley 1 and slides 2,3, and 4 are mounted on a pole at one end of the cowshed. By means of a motor or a hand crank. the pulley is set in motion and moves at 70 to 90 revolutions per minute. Slides, and a rod. 5, projecting therefrom, which is provided with a lengthening tube 6, and connected with a bellcrank, trasmit the drive to an angle iron rod 9, which is about 1 inch thick, and is suspended on the links, 10 from and along the ceiling, the rod 9 thus receiving a reciprocating motion. The two small arms 13 transfer the motion from this rod to the overhead couplings 14, 15, each consisting of a rod 14 running within a tube 15, in such a manner that the rod and the tube move in opposite directions. The milking apparatus proper, is suspended under the udder of the cow on two girths supported by the animal, and has four independent teat cups with rubber stalls and celluloid tubes. The whole is set in motion from the overhead shafting by means of the steel spirals 20, 21. The pressure exerted by the teat cups on the teats is adjusted automatically by the levers 17 and the springs 18, and by this arrangement equal pressure in exerted on big or small teats.

The British disposal interests in this machine are placed with Messrs A. D. **Bredengerg** and Co. Monument Buildings, Monument Square. London EC 3.

RURAL ECONOMICS

427 - The Reproduction of the Results of Raising Livestock in the Accounting Status of the Farm. — Kluberger, Prof. Dr., in the *Deutsche Landwirtschaftliche Tierzucht* Year XXIV, No. 16, pp. 15-16. Hanover, April, 1920.

The author has evolved an accurate method for gauging the reproduction and establishment of feeding according to individual requirements (" Fütterung nach Leistung "), of rations necessary for the different groups classed as regards their requirements, as well as the cost of food production (" Fütterkosten ") according to the accounting situation of the farm (" Wirtschaftsetat "). Exact reproduction depends upon the introduction of an empirical estimate (" erfahrungsgemässer Entwurf ") into the accounting. Also it is necessary that the actual conditions of the farm should be reflected in the montlhy live-stock account (" monatlicher Haltungsbericht "), so that at the end of the feeding period (" Fütterungsperiode ") the actual state of the rations, livestock rearing, and cost of food production is reflected in the year-book (" Jahresbericht ") with the monthly accounts for 5-6 months as a basis.

In the empirical estimate, a feeding plan (" Fütterungsplan ") is established based on the monthly books. An illustration of this plan is given below. The data given are taken from the monthly books of a dairy-farm controlled by the author. The market price of straw and hay are included in the Table, as the old assumed price of these fodder crops + land rent no longer exists at present.

Milk Production.

		per day	per month	per 6 months
Group I.	9 cows at 3 litres	27 litres	810 litres	4 890 litres
Group II	18 » » 9 »	162 »	4 860 »	29 160 »
Group III	8 » » 16 »	128 »	3 840 »	23 040 »

[427]

Plan of food supplv for milch co

35 milch cows (winter ration)	Ration per day per head						Composition				Total ration per day (q ials)						Cost of ductic %
	Oats	Barley	Wheat husks	Mangolds	Rye bran	Colza cake	Dry matter	Protein	Nutritive coëfficient in relation to the starch	Nett cost *marks*	Oats	Barley straw	Wheat husks	Mangolds, beet	Rye Bran	Colza cake	
Group I. 9 arimals of 5 quintals producing 0-6 litres of milk per day.	10	—	—	—	—	—	8.5	0.24	1.9	2.00							
	—	5	—	—	—	—	4.28	0.03	0.15	0 50							
	—	—	5	—	—	—	4.20	0.04	1.21	0.30							
	—	—	—	40	—	—	4.80	—	2.50	2.40							
	—	—	—	—	2	—	1.75	0.23	0.99	0.60							
	—	—	—	—	—	1	0.90	0.23	0.61	0.60							
							22.43	0.77	7.36	6.40							
							Total per day				0.5	0.22	0.22	1.80	0.9	0.04	57.
							Total per mouth . . .				13.5	6.7	6.7	54.0	2.7	1.3	28.
							Total per ½ year				81.0	40.1	40.10	324.0	16.2	8.1	68.
Group II. 18 animals of 5 quintals producing 6-10 litres of milk per day.	10	5	5	40	2	1	22.43	0.77	7.36	6.40							
	5	—	—	—	—	—	4.28	0.12	0.95	1.00							
	—	—	—	10	—	—	1.20	—	0.60	0.60							
	—	—	—	—	4	—	3.5	0.43	1.88	1.20							
	—	—	—	—	—	2	1.82	0.61	1.36	1.20							
	15	5	5	50	6	3	33.23	1.78	12.15	10.40							
							Total per day				1.2	0 4	0 4	4.5	0.54	0.27	87.
							Total per month				40.5	13.5	13.5	135.0	16.2	8.1	16.
							Total per ½ year				243.0	81.0	81.0	810.0	92.2	48.6	96.
Group III. 8 animals of 5 quintals producing 12-20 litres of milk per day.	15	5	5	50	6	3	33.23	1.78	12.15	10.40							
	—	—	—	—	4	—	3.50	0.43	1.88	1.20							
	—	—	—	—	—	1	0.90	0.23	0.61	0.60							
	15	5	5	50	10	4	37.63	2.44	14.64	12.20							
							Total per day				0.1	0.2	[illegible]		0,4	0.16	97.--
							Total per mouth				18.0	6.0	6.0		12	4.80	2928.0
							Total per ½ year . . .				108.0	36.0	36.0		72	28.80	7568.0
							For all groups:										
							per day				2.4	0.37	0.37			0.47	34[illegible].40
							per month				72.0	26.20	26.70			14.2	10272.00
							per ½ year				432.0	157.50	157.50			85.0	61632.00

Cost of food production in 6 months.	61 632 *marks*
Milk production 57 060 < 0.60 *marks*.	34 236
deficit . . .	27 396 *marks*

Total cost of livestock raising in 6 months : —

(1) Cost of food production	61 632 *marks*
(2) Interest on 105 000 *marks* a 5 %, 5 % for risk and 1/2 % for depreciation	5 250 »
(3) Cost of manual labour	3 500
Total . . .	70 382 *marks*

$$\text{Cost of production of 1 litre of milk} = \frac{70\ 382}{57\ 060}\ \textit{marks} = \mathbf{1.235}\ \textit{marks}.$$

On this basis of feeding, the agriculturist can easily see the price of rearing a calf from the time it is weaned until full grown. Also he can see the cost of food in the production of a litre of milk, comparatively to the production of the different groups, and is able to give the exact quantity of food necessary per day, and per feeding period. It is obvious that it is necessary to introduce into the general farm account, besides an account for feeding, one for fodder and straw showing the amounts necessary to the farm, and their cost, so as to ascertain what proportion of the whole farm expenses the food represents.

AGRICULTURAL INDUSTRIES

428 - Second Exhibition of Wines from Hybrid Vines at Perpignan, France (1). — LLOBET, J., in *Le Progrès agricole et viticole*, Vol. LXXV, No. 7, pp. 165-167. Montpellier, February 13, 1921.

NOTES MADE ON THE BEST RED WINES EXHIBITED.

No. 5. (Vaucluse) Conderc	No. 3,12.4°	With special flavour, excellent appearance, has a great future
No. 62. Gard	No. 7120,11.5°	Excellent wine, type to be retained perfect table wine, special flavour.
No. 80 (Var).	—	Good ordinary wine, highly coloured.
No. 131 (Var).	rose-coloured	Excellent, very clean taste much special flavour.
No. 167 (Pyr O)	14.4°	Type of very fine Alicante highly coloured, very mellow.
No. 138 (Var)	14.7°.	Type of a cheap wine, good, red table wine.
No. 136 (Var) Siebel 1077 (17° tested)		Excellent "Mistelle" type; from high slopes delicate.
No. 49 (Laudes) Baco 1		Good complete full-bodied, wine coloured type of the French hill-slope wines.
No 51 (Landes) Baco Estellat		Good wine, clean taste, delicate flavour exact type of hill-slope Carignan variety.
No. 25 (Tarn-et Gar) Seibel 4643, 12.80		Ordinary type, very dry, special flavour.
No. 27 (Drôme)		Good, with clean taste
No. 46 (Béziers)		Excellent blending-wine, represents Roussillon type.

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(1) See *R.*, April 1920, No. 458. (*Ed.*)

No. 89 (Rhône)	Good ordinary wine, colour secondary, delicate. mellow.
No. 108 (Aude) mixture of 7120 and 4643	Excellent ordinary wine, not harsh, pleasant taste, keeps well.
No. 61. (Gard) mixture of Seibel 1, 2044, 4499 and Condere 7120,	Excellent blending wine, Carignan type, dry not harsh.
No. 148. (Gien) Gaillard 194	Rosy type, mellow, agreable.
No. 146 (Alsace) Oberlin 595	Red wine, ordinary type, fruity.
No. 147 (Alsace)	Rosy, dry, excellent.

It can therefore be concluded that, though some hybrids produce mediocre, and very bad wine yet many of them, if carefully chosen, yield an excellent product satisfactory from every point of view, provided due care is given to the making

With the exception of some old Gaillard 157 wines (which were perfect and had a fine Sauterne flavour), Séibel 5213, 4986, 5409, and Castel 1832, the white wines of the year shown at the exhibition were generally defective.

In addition to being too new, and not sufficiently mature for it to be possible to judge of their future value, it appeared that they had suffered from the cold and the journey.

429 - **Action of Oxygen on the Must of Red Grapes.** — I. Piédallu A., Malvezin, Ph and Grandchamp, L., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 24, pp. 1230-1231. Paris, December 13, 1920. — II. Sannino, S. A., in the *Rivista di Ampelografia*, Year II, No. 1, pp. 10-11. Alba, January, 1, 1921.

I. — Bouffard and Semichon have recorded the action of air upon the colouring matter of rose-coloured musts. (*Revue de Viticulture* Dec., 2, 1899).

During the autumn of 1920, the authors studied the action of pure, finely diffused oxygen upon the musts of red grapes, using for this purpose a cylinder of oxygen compressed under a pressure of 150 atmospheres and a manometer, fitted with a rubber vacuum tube terminating in a Chamberland filter. The experiments were carried out on Aramon, Gamay, and Malbeck musts in casks. As the results obtained were practically the same, the authors only describe one experiment, that made on the Gamay musts.

The fresh must is placed in a deep glass beaker in order that the progress of the reaction may be carefully observed. The oxygen, which is kept at 4 g., passes through the porous walls of the filter and diffuses, in the form of small bubbles, through the must. The latter having the usual colour of thick, red grape must, darkens gradually under the influence of the strong oxidation due to the extremely-finely divided condition of the pure oxygen, and finally becomes quite brown. As the must changes colour, the oenocyanine and the peroxidised tannoid colouring-matters, are precipitated, the must is then filtered, and a golden filtrate slightly tinged with rose, is obtained.

As ZENGHELIS (*Comptes rendus de l'Académie des Sciences*, Vol. CLXX, p 883, 1920) also stated, gases finely divided by passing through a porous membrane, behave as if they were in a nascent condition, their action being thus considerably increased, which explains the rapidity and intensity of the reaction.

CONCLUSION. — The musts of red grapes, which are much used in Champagne and various other parts of France can be made into white, or rose-coloured, wines by the simple expedient of using pure oxygen, which has been very finely divided by diffusion through the porous walls of a Chamberland filter, and without the addition of any chemical decolorant.

II — After referring to the preceding article, Prof. SANNINO adds the following observations: —

The wine-making process studied in this paper has been described, not only by BOUFFARD and SEMICHON, but also previously by MARTINAND of Marseilles. The innovations introduced into the experiment by PIÉDALLU and his collaborators consist in the substitution of compressed oxygen for ordinary air and in the use of a Chamberland filter, instead of a pump, for introducing the gas into the must. The use of oxygen instead of air is not justifiable from the point of view of technique, for ordinary air is a very good decolorant, provided the acid content of the red grapes is not high, and that they contain sufficient oxydase, a fact which is completely disregarded by PIÉDALLU and his collaborators their experiments having been carried out on must from grapes containing little acidity, and hence easily decolorised. As regards economy, air is obviously cheaper than oxygen.

There is however, nothing new in the use of the Chamberland filter. Dr. R. CARPENÈ used it at first in his experiments at Conegliano, but afterwards replaced it by a canvas fire hose attached to a cellar-pump and closed by a plug of wood firmly tied to the end inserted in the must.

The last conclusion, viz., that oxygen can produce colourless or rose coloured musts without the assistance of a chemical decolorant, needs examination and explanation.

It was MARTINAND who proposed the addition of a small quantity of animal charcoal to the must after passing the air through the latter. This was in order to remove the last traces of orange-colour (mixture of yellow and red), or pink, and to prevent the colouring matter that had been rendered insoluble by the air, from being partially redissolved in the alcoholic liquid during fermentation.

Animal charcoal is unnecessary whenever the filtered must assumes a straw-colour after the passage of the oxidising gas; this easily occurs in the case of Isabelle, Gamay, and Aramon musts. If, however, the must' has become brown, filtration will give a golden, orange, on pink must. These colours become less intense during fermentation, but do not entirely disappear, and thus in order obtain light straw-coloured wines, the addition of animal charcoal is necessary.

On the other hand, if the animal charcoal is well purified (such pure charcoal is on the market), it in no wise harms the liquid, odourless must. The troubles arise later, during and after fermentation, at the time when the animal charcoal has lost most of its activity. Exception must naturally be made of the musts of aromatic grapes (muscats), which give wines poor or even deficient, in bouget, if animal charcoal has been used as a decolorant.

430 - Alcohol from the Prickly Pear (*Opuntia vulgaris* and *O. amyclea*). —

PANTANELLI, E., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, Part. 12, pp. 451-470, Bibliography of 13 works. Modena, 1912.

The author has undertaken a series of experiments in the manufacture of alcohol from wild plants growing in south Italy (1).

In the present article, he studies the use for this purpose of *Opuntia vulgaris* and *O. amyclea*, two species already cultivated in Sicily, for their edible fruits. The third wild species, *O. Dillenii* is chiefly used for making hedges in the coastal region of East Sicily.

The author passes in review the various attempts to manufacture alcohol from *Opuntia* dating from the middle of last century to the present time, and described his own experiments carried ont in Rome with fruits bought at the market, and hence not fully ripe.

The fruits used in the different experiments consisted of 28 to 32 % of skin, and 72° to 68 % of pulp. The method adopted was as follows: — The fruits were peeled; the pulp was boiled for 20 minutes in half its volume of water; then pressed, and fermented, or crushed and fermented. The skins were treated in the same manner, but separately. The following facts were observed: —

In the natural fermentation of the juice or pulp of the prickly pear, mycoderms, lactic, acetic, and butyric bacteria develop more easily those wild yeasts (*Saccharomyces Opuntiae*); these micro-organisms transform the sugar into substances which are not alcohol, hence impede the use of the cactus for the production of alcohol. If a selected alcohol-yeast is added to this pulp or juice (prepared without heating), the yeasts have to compete with the above-mentioned micro-organisms and cannot give the yield expected. If however, the fruits are pressed, and the juice is sterilised by boiling before the selected yeast is added, the alcohol yield is proportionate to the sugar content of the juice.

Boiling and pressing before fermentation can be dispensed with, if the figs are crushed when cold, and 30 gr. of potassium metabisulphite per quintal is added at the same time as the specially selected yeast is introduced. By this means, a higher yield of alcohol is obtained than by inoculating the boiled pulp with pure yeast for this avoids the destruction of the enzymes present in the ripe fruit which transform the collidal carbohydrates and glucoside into sugar.

In the pulp, and still more in the skins, part of the sugar is found in a glucosidic combination, probably the chromogene of the red colouring matter. During fermentation, this glucoside splits off. There is, in addition, much sugar-producing mucilage as well as traces of starch. The juice must not be treated separately from the pulp. The glucoside and carbohydrates present are used to the fullest extent when the raw pulp has been fermented with metabisulphite and selected yeast.

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(1) See *R.*, Jan 1909, Nos. 43 and 108. (*Ed.*)

Fruits which are perfectly sound give better results that those attacked by the larvae of *Ceratitis capitata* although they contain less sugar, for they have a higher glucoside content, and the juice although poorer, in soluble substances, is less adapted to the development of lactic bacteria. The alcohol from maggoty fruits also contains more viscid matter, so that the larva-infested portions of the fruits must not be kept for distillation.

With the bisulphite method, at least 9 litres of water-free alcohol are obtained per quintal of fruits, that is, 1 hectare, of especially cultivated *Opuntia* would produce at least 16 hectolitres of absolute alcohol.

There remain in addition: 900 kg. of pressure residuum, good for fuel and containing 64 kg. of oil, 5 kg phosphoric anhydride, and 97 kg. potash and soda; 450 kg. of dry pomace suitable for a compound fertiliser, or stock-feed, for it contains 135 kg. of nitrogenous matter, 6 kg. of phosphoric anhydride, and 13 kg. of potash and soda.

The cost of the prickly pears where they are grown was estimated, in 1919, at 25 lire per 1000, adding the cost of carriage to the factory, which would amount to 2 lire per quintal, the raw material delivered at the factory would, at the present time cost 4050 *lire* per hectare. This would leave a good profit after deducting the expenses entailed in making the alcohol. In addition, the residual pulps and the pomace are of a certain value.

431 – **Changes Taking Place in the Tempering of Wheat.** — TAGUE, E L., (Dept of Chemistry, Kansas Agricultural Experiment station) in *Journal of Agricultural Research*, Vol XX, No 4, pp 271-275, tables 3 Washington D C Nov: 15, 1920.

In milling wheat it has been found advisable to temper or condition the grain before grinding. This process consists in adding a certain amount of water to the wheat, then thoroughly mixing and allowing it to stand for a time. The treatment toughens the bran coat of the kernel, thus making possible a separation of the bran and the flour and increases the desirable milling qualities of the wheat in other ways. The yield of flour is increased and a flour is obtained which permits a better quality bread being made

Three varieties of wheat were used for the experimental work: (1) Kanred. — hard var. with 12.65 % moisture content: (2) Turkey or Kharkof. — hard red var. with 10.86 % ditto. (3). Arizona white wheat, — soft var. with 10.8 % ditto. The only chemical changes considered in this study were changes in hydrogen-ion concentration, total acidity, water soluble phosphorous and titrable nitrogen.

Different periods of time, temperatures and moisture contents were compared as follows: — (1) Time, 24, 48 and 72 hours; (2) temperature, 5°, 20° and 40°C; and (3) moisture content, 15 ½ and 18 %.

When the wheat was tempered at 5°C there was practically no change as compared with the untempered wheat, but as a general rule the yields were slightly higher and the milling qualities were considerably better than those secured from the latter. The length of time appeared to have very little influence on either the physical or chemical composition of the flour.

At 20°C, the hydrogen ion concentration was increased, the total acidity, water soluble phosphorous, and titrable nitrogen were also higher, and there was a distinct advantage over the results at 5°C. The chemical changes were still more pronounced when the grain was tempered at 40° C and the physical changes appeared to be detrimental after 48 hours so far as the milling value of the wheat was concerned. In general the milling qualities of the drier wheats were improved by tempering more than those of the wetter wheats, and the hard wheats more than the soft, and a 15 ½ % moisture appears to be about the best.

432 - **Possible Substitutes for Almond Oil.** (1) — **Apricot and Peach Kernel Oils.** — JURITZ. C. F., (Agricultural Research Chemist.) in *Journal of Industries.* Vol. 3, No. 11, pp. 1052-1057. Pretoria, Nov., 1920.

The apricot and peach kernels, as well as the almonds both bitter and sweet, contain a ferment known as emulsin which consists of two engymes, prunase and amygdalase. This ferment is capable of acting on the glucoside amygdalin producing what is known as the essential oil of bitter almonds, the amygdalin in the process taking up water and forming benzaldehyde and hydrocyanic acid:

Peach kernels yield from 32 to 35 % of fixed oil (*Oleum amygdalae persicae*) which can be substituted without detriment for the almond oil (*Oleum amygdalae*), but owing to the high cost in South Africa its place has been taken mainly by pea nut oil (*Oleum arachis*).

Apricot kernels contain from 40 to 45 % of a similar fixed oil, (*Oleum pruni armeniacae*) which is used as an edible oil in addition to replacing almond oil. The oil may be obtained by crushing and grinding the entire seeds of the apricot, — kernel and shell together, — and the pressing for oil extraction which may be aided by the application of heat or the addition of wàter, or both. An analysis was made by COPENHAGEN W. J. in the laboratory, to ascertain the proportion of oil likely to be yielded by apricot stones, and the physical contents of such oil, and to compare these with recorded analyses of apricot kernel oil from elsewhere.

The following table shows the results obtained: —

Average weight of apricot stone	2.22 gm.
Average weight of kernel	0.47 »
Percentage of kernel in stone	21.35 »

The kernels apart from the shell, were analysed with the following percentage results : —

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(1) See also *R.* Sept. 1916, No. 1920 (Fixed and Volatile Cherry Oils) — *R.* Feb, 1917, No. 185 (New Process for Extracting Oil from Kernels of Stone Fruit) — *R.* July, 1917, No. 639 (Oil from Plum Stones) (*Ed*).

	In Fresh kernels	In Dried kernels
Moisture	7 06	
Ash	3 10	3 [illegible]4
Proteins (N. × 6 25) .	24 39	20 2[illegible]
Oil .	35 26	37 97

Oil content : — Specific gravity at 15.5°C . 0.9211, saponification value 179, acid value 1.83, refractive index at 40°C, 1.4646, iodine value 112.

The apricot kernel oil, after pressing and allowed to clarify by settling, is almost colourless, but gradually acquires a yellow colour. Its flavour is mild and pleasant. It is however noted that the London firm which claims to have been the first to introduce British-pressed oil of peach or apricot kernels, points out that, although this oil is genuine, and may be legitimately employed, its surreptitious substitution for almond oil should be discountenanced.

The 1914 British Pharmacopoeia lays down the following limits for almond oil : —

Specific gravity 0.915 to 0.920; saponification value 188 to 196, acid value 1.4624 to 1.4640, iodine value 93 to 100. The similarily between this and the apricot oil analysis is evident.

The volatile or essential oils in both cases are derived from their respective sources by processes wholly different from and subsequent to those by which the fixed oils are obtained, namely, by treating with water the cake or marc remaining after expressing the fixed oil, leaving it to macerate for 24 hours or more, and then subjecting the mash to distillation. Bitter almonds yield from 1 to 3 % of this essential oil and the South African apricot kernels, 5 % (*Oleum amygdalae persicae essentiale*). The purification of this oil is effected by redistilling it over ferrous hydroxide. This accounts for the fact that 2 varieties are on the market, one containing and the other freed from hydrocyanic acid, S. A. P. (*sine acido prussico*). That containing the acid is on account of its fairly stable composition, regarded as one of the best-forms in which that powerful drug can be administered.

433 – **Cantaloup feed Oil.** — BAUGHMAN, W. F., BRAUNS, D., and JAMIESON, G S. (Contribution from the Oil Fat and Wax Laboratory, Bureau of Chemistry Department of Agriculture), in the *Journal of the Chemical Society*, Vol XLII, No 11, p. 2398-2401 Easton, Pa, Nov, 1920

Considerable quantities of unmarketable cantaloup (*Cucumis Melo* L.) are allowed to remain on the fields. It the melons are collected and dumped into shallow pits, they soon decompose so completely that the seeds can readily be recovered by raking them from the pits.

A large sample of cantaloup seed was received from the Imperial Valley, Cal An ether extraction showed that these seeds contained about 30.4 % of oil. The seeds were pressed in an expeller, and the chemical and physical characteristics of the oil thus obtained were determined The chemical composition is given in the following table.

Composition of Cantaloup Seed Oil.

		Per cent.
Glycerides of	Myristic acid	0.3
	Palmitic acid	10.2
	Stearic acid	4.5
	Oleic acid	27.2
	Linolic acid	56.6
Unsaponifiable matters		1.1

434 - **Industrial Value of the Waste from Tomato-Canning Factories.** — FACHINI S., in the *Bollettino della Associazione italiana Pro Piante Medicinali, Aromatiche ed altre utili*, Year IV, No. 1, pp. 11-13. Milan, January, 1921.

There are many tomato-canning factories in Italy, especially in Emilia, Campania, Sicily, and Sardinia. The author suggests that the waste products of the industry, which hitherto have only been partly used, should be turned to full account.

The tomato residue, on leaving the factory, contains: 70 % liquid, 22 to 24 % seeds, and 6 to 8 % skins.

The seeds yield, on being pressed, a drying oil with the following characters: —

Density at 15° C	0.9215
Refractive index	1.4745
Saponification value	0.46
Iodine value (Hubl.)	191.6
Iodine value of the liquid fatty acids	140-142
HEHNER index	93.6
REICHERT-MEISSEL index	1.00
Index of neutralisation of fatty acids	199.1
Average molecular weight	291.8
Solid fatty-acid content	12.95
Liquid fatty acid content	87.15
Acetyl value	20.4
BAUDOIN reaction	negative

The results of analyses of tomato-seed cake were as follows: —

	Per cent
Moisture	5.30
Ash	6.50
Crude protein	32.50
Crude fats	12.00
Crude fibre	22.70
Nitrogen-free extracts	21.00

This cake has been found to be an excellent cattle feed, and can be compared with linseed cake.

The oil obtained by pressing well-preserved seeds in the cold, is of a light straw colour, has an agreable taste and constitutes, good edible oil, as is also that yielded by fermented seeds, after the unpleasant acid taste is removed by modern methods of refining. Tomato oil is also used in the soap-making industry. Soap made from tomato oil alone is wanting in consistency, but with the addition of 20 % of suet, palm oil, or coconut oil an excellent laundry soap is obtained.

The crude neutralised oil, can serve as a lubricant, or for lighting; it pays best however to refine it for edible purposes.

From information obtained and laboratory experiments made by the author, it appears that the tomato-canning factories of the Province of Parma alone, furnish annually: —

By the treatment of 800 000 quintals of tomatos, 40 000 quintals of moist waste yielding 9000 quintals of dry seed from which are obtained: —

1620 quintals (18 %) expressed oil.
7200 quintals cake.
2000 quintals (5 %) dry skins.
From the dry seeds, by extraction with solvents, can be obtained:
2070 quintals (23 %) oil.
6750 quintals (75 %) residuum.

Some profit could also be made out of the skins, and the yellow liquid expressed from the damp pomace could possibly be turned to account, as owing to its relatively high content of levulose, citric acid, and fertilising substances, its value is by no means negligible.

435 - **Experiment with the Drying of Vine Fruits.** — Lyon A. V., (Mildura Research Committee), in *Science and Industry*, Vol. 2, No. 10. pp. 625-629. Melbourne, October, 1920.

Experimental work in connection with the drying of Zante currants and sultanas has been in progress for the past 2 seasons. The report here given shows the aim and extent of the investigations carried out by the Mildura Research Committee, in co-operation with the Institute of Science and Industry and the Victorian Department of Agriculture. Two of the principal problems dealt with, have reference to: (1) the estimation of loss in weight in process of drying; and (2) the dipping strength for sultanas, including the relationship of the strength and temperature of dip to the colour of the dried fruit (sultanas).

I. — The sample of fruit for testing was in every case, composed of berries without signs of wilt, as, obviously the density of the juice increases as wilting progresses. The fruit (about 2 cwt. green) was weighed at the green and at the dried stage (unstemmed) for comparison purposes. Results indicated that picking at an early stage (under 13, Baumé reading) is not a paying proposition. In the case of Zante currants, a Baumé reading of 14 shows the minimum stage of ripeness at which they can be profitably harvested.

II. — In field practice it is customary to dip the buckets of fruit in a caustic-soda solution at, or just below, boiling point, or to dip at a ower temperature (190°-195°*F*). At this lower temperature, 15 to 20 % increase in quantity of caustic soda is required to give similar results to those obtained with the boiling dip. In this set of experiments, the following course was adopted with each sample: — A weak solution of caustic soda (1 in 60) was prepared, and strengthened as required by adding more, as calculated to reduce the water relatively by 5 galls, to each 1 lb. of caustic soda. Trials were made at each strength and the maximum and minimum concentrations recorded. All dipping was done at boiling point. The figures obtained were as follows: —

Baumé Reading (as gallons of water to 1 lb. of caustic soda, measure of ripeness). (Commercial 99 %).

Density of dip in degrees Baumé	First cracking	Approaching over cracking
12.1	60	40
13.2	50	35
13.8	45	35
14.15	40	30
14.2	40	30
14.75	30	20

In the operation of dipping, the net result is a concentration in strength and a considerable diminution in volume. An attempt has been made to meet this problem, but this work is at present incomplete.

Although the strength of the dip is only one of the factors controlling the colour of the dried product, generally speaking the quicker the process of drying, the higher and more even will be the colour. Unduly weak dips should therefore be avoided as they lengthen the drying period.

The following recommendations, amongst others, are made by the authors: —

(1) Apply the Baumé test as a measures for ripeness, and delay picking until the juice gives a satisfactory test; (2) Clean out the dip frequently to remake at a suitable strength, and thus avoid variation in concentration as far as possible; (3) Racks should be so placed that they receive a minimum of dust, and dried fruit taken to the packing sheds should be covered, and sufficient rack space provided to secure thin spreading.

436 - **Utilisation of "Rifatto" in the Manufacture of Paper Pulp.** — Di Palma, S., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Pts 10-11, pp. 393-394, Modena, 1920.

In Sicily and Calabria, the term "rifatto" is applied to the ligneous portion of the roots of the liquorice which remains after extraction of juice. A method patented by the author (Municipal Chemical Laboratory, Messina) permits the extraction of a new juice "rifatto," and the entire juice is in this way utilised. After this second extraction, there remains only a small quantity of crude cellulose material in the form of very fine dark red fibres.

"Rifatto" contains about 50 % crude cellulose, which can be utilised in the manufacture of paper pulp, which has an advantage over wood and scraps owing to the high cost connected with the latter to acquire the necessary subsistence.

The experimental tests made with this material in a paper factory at Bergamo have given successful results Considering the large amount of residue which may be collected in Sicily and Calabria the author recommends its use for the manufacture of paper in Sicily.

437 - **The Mat-Industry in Tonkin.** — *Annales de l'Institut Colonial de Bordeaux, Bulletin mensuel*, p. 245. Bordeaux, August, 1920.

The mat industry is a speciality of Tonkin, but with one exception, the factories are in the hands of Chinese. On an average, 3500 metric tons of mats valued at about 2 million francs are exported each year. The native weavers use vertical looms, but French specialists have begun weaving on horizontal ones. It takes 3 or 4 months to learn to use the latter, and the weaving is slower than when vertical looms are employed, but the carpets made are more beautiful, and with a greater variety of shade.

Mat-weaving will always remain a Tonkinese monopoly, for the rushes which form the raw material, cannot be exported on account of their weight. Rushes in their natural condition are sold at 15 *piastres* per 100 kg. in the Ninh-Binh district, and a carpet 3 m × 3.50 m. weighs 25 kg.

438 - **Estimation of Added Water in Milk Analyses** (1). — BOUIN, M, in the *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXIV, No 2, pp 89-91. Paris, January, 15, 1921.

In calculating the amount of added water in watered milk 90 gm. of the fat free extract, an average which is generally agreed to, is taken as. the basis. In many cases, however, the content of fat-free extract is very different from the figure arbitrarily adopted. The author has shown that its normal variations may exceed 20 %, which is enough to prove the uselessness of calculations of added water based on the hypothetical amount of 90 gm. of fat-free extract per litre

Ch. PORCHER (1) is of opinion that the figures relating to the fat-free extract would be more accurate, or more correctly speaking, less variable, if the fat-content of the milk were taken into account. He proposes to substitute the fat-free extract content obtained directly, which he calls the crude fat-free extract (extrait dégraissé brut, E. D. B.) by the fat-free extract of milk that is supposed to have been perfectly skimmed, and which he calls the " rectified fat-free extract " (extract dégraissé rectifié E. D. R.) these two figures being connected by the relation:

$$(E.\ D.\ R.) = \frac{(E.\ D.\ B.) \times 1000}{1000 - \frac{G}{0.92}}$$

G being the fat-content of the milk.

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(1) See *R.*, May, 1917, No 484; *R.*, Jan, 1920, No. 123. (*Ed.*)

The author states that the lesser variability of E. D R. is only illusory. In fact, the crude fat-free extract is a function of the physiological condition of the cow and varies considerably with the age of the milk He has shown that the fats and fat-free extract which occur in only small quantities in the milk of cows recently come in milk, increase considerably as the end of the lactation period approaches. It can well be understood that, under these conditions, the correlation can but increase the difference between the fat-free extract content of cows recently in milk, and those that have been giving milk for some time.

It would therefore appear to be necessary to find, for the estimation of added water, a less variable constant than the fat-free extract. Cryoscopy is one of the best means of obtaining a physical constant. The following chemical formula suggested by the writer gives results very similar to those obtained by cryoscopic methods: —

$$\text{added water } \% = \frac{85 - (L + 5\,c)}{85} \times 100$$

Here L is the amount of hydrated lactose in 1000 parts of milk. C the crude ash content of 1000 parts of milk, and 85 the average content of the constant $(L + 5\,c)$.

The author applied the various methods of estimating added water to 20 samples of milk, all containing 10 % added water; and found: variations from − 10 to + 11.4 when the crude fat-free extract was taken as a basis; variations from − 13.3 to + 13, when the rectified fat-free extract was used as a basis, and variations of as little as −2.2 and +3.3, when the constant $(L + 5\,C) = 85$ was employed. He therefore states that there should be no further doubt as to the choice of the constant to be adopted in estimating added water in samples of milk.

439 – Comparative Study of Methods of Determining the Fat-Content of Cheese. —

BORELLO, O., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, Part 12, pp. 471-493. Modena, 1920.

The estimation of the fat content of cheese is a matter of great practical importance, seeing that many States use the fat content in the Customs classification of cheeses; further, many contracts are based on the classification of cheeses as "nearly fat less," "half-fat," and "fat."

In his experiments, the author has compared the methods of SOXHLET, RÖSE-GOTTLIEB, GERBER, and SCHMID-BONDZINSKI and arrived at the following conclusions: —

The last-named method gives much the highest results.

Two extractions are sufficient to eliminate the fat from the acid solution, the amount remaining in the latter being negligible.

Ethyl ether is the best solvent to use for extraction. The author does not agree with SIEGFELD, who considers the GERBER-method impracticable for a dairy-staff who are unaccustomed to using a chemical-balance.

The experience of 5 years teaching the practical chemistry of milk in in the theoretical and practical cheese-making course given at the " R. Stazione sperimentale" of Lodi, enables him to state that the dairy staff is able to determine the fat content of the cheese according to GERBER's method, even if they cannot give all the details of the operations. An approximative method can always be employed by the chemist, as well as by the technical worker. It gives satisfactory results, especially if butyrometers calibrated for 3 or 2.5 gm. of cheese, with flat tube, are used, each division marking ½ %.

When great accuracy is needed on account of the delicacy of the analysis, or for scientific reasons, the SCHMID-BONDZINSKI method should be used, which gives exact results in a relatively short time. No special apparatus is needed, the ordinary laboratory apparatus being sufficient.

The method becomes excessively simpleed, if a modified a siphon devised by the author is used for decanting off the ether solution, as it is thus possible to regulate, or even stop, the passage of the etherised fatty liquid. By the use of this method, accurate results for any kind of cheese can be obtained.

440 - **The Latest Results of the Enquiry into the Spontaneous Combustion of Hay.** — LAUPPER C., in the *Landwirtschaftliches Jahrbuch der Schweiz, Beilage zu den Mitteilungen des Veterinäramtes und der Abteilung für Landwirtschaft des eidgenössischen Volkswirtschafts-Departments*, Year 34, pp. 1-54, figs. 5, Bibliography of 65 works. Lucerne, 1920.

The author, in treating of this interesting subject, makes use of the copious literature dealing with the matter from the theoretical and experimental standpoints, and in which not only the main question, but also its side issues are discussed. After having spoken of the two previous hypotheses brought forward to explain the spontaneous combustion of hay viz., "chemical" combustion and "biological" combustion, he unites them, and describes the present state of our knowledge of the subject. The rise in temperature of the hay is now-a-days attributed to three different causes, which would seem to produce three phases summarised in SCHENK's figure. In the first phase, the cells of the plants forming the hay are not yet dead, and therefore continue to respire, with the liberation of a considerable amount of heat (interval up to 45°C) and the hay transpires moderately; in the second phase, the fermenting action of the microorganisms, including those that are thermophilous, would appear to come into play, producing a further rise of temperature (interval from 45°C to 70 or 80°C), and the hay transpires profusely; in the third phase, it is supposed that direct chemical oxidation takes place with the assistance of pyrophoric iron, and is accompanied by the liberation of intense heat; then as the hay is already predisposed to overheating, spontaneous combustion ensues (1). After having discussed the arguments as to whether microorganisms, enzymes, or catalytic agents take any part in the process or not, and after comparing this spontaneous combustion with the fermentation of tobacco, the author expresses his opinion that the former cannot be attributed to bacterial action.

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(1) Cfr. O. KELLNER, *Die Ernährung der landwirtschaftlichen Nutztiere*, Berlin. Parey, 1916, p. 235. (*Ed.*)

ON THE DEGREE OF HEAT CAUSING HAY TO CATCH FIRE. — There is one weak side to all the views hitherto put forward viz., the temperature at which hay catches fire was never given. In order to settle this point, a hay combustion experiment was recently carried out at the Swiss Agricultural Experiment Station at Liebefeld (Berne). A large quantity of hay was piled up under a shed, in which was placed a stand holding maxima recording thermometers, that were visible at a distance. Everything was so arranged, that when the temperature of the heap of hay reached 73°*C*., a Wood alloy fused, thus permitting the escape of the carbon dioxide contained in vessel placed in the centre of the hay, and allowing it to penetrate into the latter.

The piling-up of the hay began on Sept. 22, 1916, and the heap was finished on the 25 th. Average moisture of hay 37-38 %. On the morning of the 26 th, the thermometer placed in the lower layers registered 30-32°*C*., in the evening it marked 40°C., whereas the thermometer put in the upper layers registered 50°*C*. On the 27 th, the temperature of the upper part of the heap was 60-65°*C*., that of the centre 51°*C*., and that of the base 47°*C*. From Oct. 2-3, the Wood alloy fused, the vessel containing the CO_2 discharged its contents into the heap, causing the temperature to fall 20°*C*. The hay was already beginning to turn dark, so we may say, that brown hay is produced at about 70°*C*.

The penetration of the CO_2 into the heap of hay only arrested the fermentation momentarily, it continued with even greater intensity after 24 hours, and brought about the third phase, that of hyper-fermentation The thermometer continued to rise and reached 80°*C*.; as for the heap it had already exuded 20.5 % of moisture.

On October 8, the height of the pile had sunk from 2.90 m. to 1.30 m. On October 11, there were 3 carbonisation holes; the hay had turned very brown, it was brittle at many points, and had a very pungent odour, although no smell of actual burning could be detected.

On October 13, at midday, the thermograph of the upper portion of the heap registered 90°*C*., but at 2. 10 p.m, the temperature rose to 388°*C*; the author attributed this last temperature to an error, and thinks that it can be corrected and reduced to 280-300°*C*. At 3 p. m, no ignition, or flames, were observed, and CO_2, was injected.

These experiments show that: — (1) The introduction of CO_2 into a plant mass, that has entered into the most dangerous stage of heating, produces no great or durable cooling, and therefore cannot eliminate the danger of fire; (2) the end of the 1st phase (up to 50°*C*.) was reached in about 2 days; the 2nd phase (50-70°*C*) lasted 6 ½ days; the 3rd phase (70°-90°*C*) 19 days; the 4 th (90°-300°*C*.) had already begun after 2 hours.

Bacteriological analysis shows that the microorganisms probably take no part in the heating of the heap of hay.

Given the difficulty of working on a large scale, the author then discusses the question whether the phenomena of the spontaneous combustion of hay could not be studied in miniature in boxes, or even in glass globes, The author advocated experimenting on a few kg. of hay in boxes, the electric resistance being used to indicate the rise in temperature. It would appear to be very difficult to substitute glass globes for experiments with a heap of hay, for the losses of heat are very great. Nevertheless, after many preliminary attempts, the author succeeded in using a glass globe for the experiment. By adding small quantities of glucose and of ammonium nitrate to the hay, it was possible to supplement the heat that otherwise would have been carried off by the surrounding air and by radiation.

In this way, by using an air oven containing a glass flask, and two thermometers, one outside and one inside the globe, and by regulating the temperature, the author succeeded in imitating on a small scale, within the globe, the thermometric course observed on a large scale in the heap of hay. In fact, by keeping the regulator at 150°*C*, and placing in the globe, hay to which small quantities of glucose and ammonium nitrate had been added, it was seen that, after a certain time of heating at the surrounding temperature (150°*C*), heat was liberated at first slowly, then quickly, and finally very quickly. It was shown by a large number of experiments, that each time the temperature rose to from 280-300°*C*., spontaneous combustion took place in the hay contained in the globe after the breaking of the latter.

The author has obtained in glass globe experiments (by adding glucose and ammonium nitrate) the same graphic thermic curves as those produced by experiments carried out in boxes.

The same experiments prove that the ignition temperature depends upon the amount of sugar and nitrate present, and that if the hay is washed in water, dried, and put into the glass globe, together with the ordinary small quantities of glucose and nitrate, no considerable rise in temperature takes place, which shows, that substances soluble in water are those which chiefly cause spontaneous combustion. It is not enough in order to obtain spontaneous combustion, to add sugars and nitrate to ordinary hay in the globe, it is necessary that the hay should be of the right degree of moisture.

The author afterwards made some experiments in a glass globe, for the purpose of determining the sources of this emission of heat in the hay. He found that: —

(1) The carbonisation of the hydrocarbons begins at 100-110°*C*. and continues with great emission of heat and the liberation of H_2O.

(2) The carbonisation of the cellulose, and other similar compounds, is also of an exothermic nature; part of the chemical heat evolved in spontaneous combustion must be attributed to the exothermic destruction of cellulose carbohydrates, while the rest is due to the sugar carbohydrates being reduced to caramel, or to C, CO_2 and H_2O.

(3) Traces of ammonium nitrate and of ammonia, lower the carbonisation point of the sugar carbohydrates to 70°*C* and even less, which explains the process of formation of brown hay. The starch carbohydrates, after the heat has acted upon them for a long time, are partially transformed into sugars, even by organic acids (oxalic, acetic, formic).

(5) Organic plant acids, even in small quantities, promote to a large

extent the carbonisation of pentoses, pentosans, and other similar compounds.

According to BOEKHOUT and DE VRIES, water plays an important part in the spontaneous combustion of hay, for it transform the substances composing the latter into a condition facilitating oxidation. Further, water brings about the dissociation of the salts of iron and manganese, and consequently causes greater ionisation, and a more intense oxidising catalysis.

In the authors opinion, all these exothermic processes, however, only explain spontaneous combustion, if it is admitted that the balls of compressed hay ("Heufladen"), which are formed in the heap owing to the stratification and compression to which the hay is subjected during the time it is piled up and subsequently, are actual thermic chambers, in which the heat of the exothermic reactions accumulates instead of dispersing. It is as if the living heap possessed an organ of respiration, in which the respiration process of the hay is localised, and where the highest productive capacity and intensity can be reached. In fact, while the heat produced by the initial respiration is used to cause further exothermic reactions and produce fresh heat, the respiratory apparatus of the hay-heap becomes a burning furnace, always situated in the centre of the mass, where the hay is most compressed, and the thermic chamber most enclosed. According to DÜGGELLI, it is only where the hay by its fineness, or great humidity, and in any case, its great compression, is well stratified, that the temperature is very high, and the mass transpires, and becomes bown. At those places where the hay is less compressed, the processes producing heating can only go on to a very limited extent and further, much heat is lost, owing to the circulation of air. The author's experiments on the subject of the rapid thermometric variations in the hay boxes have convinced him that a hay-ball may catch fire at one point, without the fire spreading further. The stalks and fibres which are compressed and adhere to one another owing to the caramelised sugar, play the parts of the wire-gauze in Davy's safety-lamp.

CHEMISTRY OF THE SPONTANEOUS COMBUSTION OF HAY. — The author discusses the problem as to whether it is a question of dry wet distillation, and confirms, by means of his glass-globe experiments, the opinion of TSCHIRCH, who regards the spontaneous combustion of hay as mainly a process of wet distillation, for which the necessary water-vapour is supplied by the transpiring heap of hay. Dry distillation also takes place, but this is confined to the second phase, when the wet distillation is finished.

In order to determine the nature of the substances that play a part in spontaneous combustion, ROCKHOUT and DE VRIES worked up some hay with water, until, there was no further reaction to Fehling's solution, then dried it, and heated it to a high temperature. Under the microscope, the section of washed, heated hay has colourless cell contents, whereas the cellular membrane of the section of ordinary hay undergoing spontaneous combustion is unaltered, but the contents of the cells are black and carbonised. Hence, the substances taking part in spontaneous combustion are chiefly those that are soluble in water, and form a considerable portion of the hay. The author, on comparing the analyses of the same ordinary hay, some of which had been heated, and the rest not, found that, whereas the initial amount of pentosans and nitrogen-free extracts in unheated hay was respectively 22.6 and 30% ; in heated hay the percentage of these substances fell to 8.9 and 10.8 %. It practically follows that the condition of the cell contents and the degree of the maturity of the grass, are the factors determining the spontaneous combustion of hay ; thus the forage and nutritive value of the hay are the measure of its liability to this over-heating, which is also influenced by the agricultural operations before and after mowing.

The author then discusses the different plant constituents which play a part in spontaneous combustion, and gives a detailed account of many of them.

Iron is not found in the aqueous extract of hay ; it appears to remain in the cell-wall. In all probability, however, this element has a threefold function. In the first instance, it would appear to have a catalytic action, like manganese, which depends on the variability of its valency. This catalysis reaches its maximum at 35°*C*., and its limit at 60°*C*. Its second function, which is also of a catalytic nature, consists in the power of greatly increasing the rapidity of carbonisation produced in organic substances by the addition of powdered Fe_2O_3, and especially in carbohydrates, when exposed to heat or a flame. MnO_2, MgO and hay-charcoal when sprinkled ever sugar or other plant substances, also accelerate their combustion. The third function is of a physical character, and the pyrophoric property belongs to the iron and not to the charcoal, as RANKE first supposed. The author bases the statement on the observations he made, in the glass globe, of the thermic course of hay and charcoal, the iron being removed by hydrochloric acid, as compared with that of hay and charcoal from which the iron had not been removed. It is well known that a trace of pyrophoric iron on sugar or sawdust causes it to ignite, white sulphur bursts into flame, and cotton-wool and hay burn with a luminous flame. Manganese, which is of such common occurrence in the plant world, has also a pyrophoric form, though it is less efficient than that of iron, and it is known that many workers regard manganese as a constituent of all enzymes. Magnesium is found in the aqueous extract of hay.

Many experiments have already proved that green plants only accumulate nitrates in darkness. Hay cutting and making, however, take place in day light. The author has reached the conclusion, based on the results of many analyses and observations, that a certain amount of ammonium nitrate (up to 2 %) can actually be formed in a ball in the hay-heap, as a result of purely chemical action.

Among the organic substances playing a part in the chemistry of spontaneous combustion, sugar carbohydrates should first be mentioned ; these occur in large quantities in green plants and hence also in the hay balls, thus some of the carbohydrates become caramelised and impart a viscous, gummy consistency to the hay. Another sugar also forms in these hay balls, in the dark, and especially at night, or as a result of cooling, and the chemico-physiological destruction of the starch. This sugar owing to its solubility in water passes out from the cell contents, thus preventing, at all events to a great extent, the reversal of the reaction.

MIEHE considers enzymes to be agents assisting in bringing about spontaneous combustion. The author finds that in fresh grass the oxydase and reductase are nearly balanced; the latter, however, is less consistent than the former. The oxidase of hay is soluble in water, and contains manganese. Through the action of atmospheric oxygen, it is transformed into a much more active peroxidase (1) that does not appear to be present in grass, and can generate the nitric radicle, Experience shows that in order for the oxydase to be able to induce exothermic reactions, it must be acted upon by ordinary water, as the water which is more or less stably combined with the plant colloids, appears to be insufficient. Since very dry hay is equally liable to spontaneous combustion, the author believes that, in this case, the water necessary for peroxidising the oxydase is obtained in the first instance from intracellular respiration, and in the second, from the *cineresis* of the plant colloids, which consists in the emission of a watery liquid, and occurs with all plant colloids being especially noticeable in dead organisms.

The first phase of the spontaneous combustion of hay is sufficiently explained by normal plant respiration; as regards the 3rd and 4th, when the temperature is over 70°*C*., there is no difficulty in attributing the exothermic processes to purely chemical action.

The question that has been most discussed is, however, the cause of the second phase, between 45°*C* and 70°*C*.; this was regarded by former experimenters as a marvellous point in spontaneous combustion, which perhaps they attributed to a transcendental cause. According to the author, this vexed question can be easily resolved into a problem which finds its explanation in colloidal chemistry, for it is not difficult to suppose, that th oxydases at this temperature are acted upon by the water of cineresis, which brings this second phase into the field of colloidal chemistry.

SUMMARY. — Very dry hay exudes a watery liquid capable of acting upon oxydases, and predisposing them to exothermic activity. This water may be supplied in part by the respiratory process, but most of it is derived from colloidal *cineresis*. Owing to the special physical structure of the heap of hay which permits of actual thermic chambers being formed, the heat liberated during the various exothermie processes accumulates, and increases to such an extent as to determine and explain the most common phenomena of the real chemical processes with their manifestations and consequences. In these processes and manifestations and in the case of temperatures exceeding 100°*C*., it must be admitted that the ammonium nitrate, which has been proved to be present in the hay and especially in the hay-balls, exerts a certain influence.

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(1) See *R*., June, 1920, No. 628. (*Ed.*)

It is therefore evident that freshly-piled hay should never be compressed, for pressure breaks the stalks, and the water issuing from the latter, in conjunction with other factors, promotes oxidation, which causes the carbonisation of most of the carbohydrates. The critical temperature under normal conditions is between 70 and 80°C. If the forage is badly dried, carbonisation can take place at a much lower temperature; it is therefore necessary to place amidst the hay safety apparatus (patented by Emile RUEGG, Schlossermeister, Zurich,) which should not be removed until the whole mass has cooled.

There are many possible ways in which dangerous oxidation processes may arise in hay, and they are not all due to the temperatures at which normal plant respiration takes place. Therefore, the agriculturist cannot feel quite easy in mind until the carbonisation of his hay has taken place, for even if the hay is very dry, some water be may engendered in the process (1).

441 - Preservation of Canvas Sacks Intended for the Reception of Products Used in Agriculture.

— LAVERGNE, G., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VIII, No. 1, pp. 29-30, Paris, January 5. 1921.

The author, having had occasion to saturate with carbon dioxide large quantities of natural alkali carbonates extracted from Vichy water, spread them, in order to carry out the process, upon screens covered with more or less fine canvas, and found the fabrics were rapidly destroyed by the corrosive action of the damp carbonates, so that it was necessary constantly to renew the canvas. The idea then struck him to silicate the material; this increased the duration of the canvas tenfold, and effected a considerable reduction in expense.

He therefore suggests that the process might be applied for the purpose of preserving the large coarse canvas sacks used for keeping various substances required in agriculture (fertilisers, chemical products, etc.) and which wear out very soon.

The experiment is most easily carried out by diluting one litre of silicate of potash or soda with twenty litres of water, immersing the sack in this mixture until it is well impregnated, then wring it out well in order to recover some of the liquid, which can be used again.

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(1) The fact that the spontaneous combustion of hay is more common in some countries, such as Switzerland, and less in others, such as Italy, suggests the importance of studying the frequency of spontaneous combustion in different localities and different qualities of hay. (*Ed.*)

PLANT DISEASES

GENERAL INFORMATION

442 – **The Creation of an Institute for the Protection of Agriculture, in Brazil.** — *Ministerio da agricultura Industria e Commercio Regulamento do Instituto Biologico de Defesa Agricola approvado pelo Decreto* N . 14 356, of September 15, 1920, 20 pp. Rio de Janeiro, 1920.

By decree No. 14356 of the President of the United States of Brazil, under date of September 15, 1920, a biological institute for the protection of Agriculture has been created at Rio de Janeiro. The duties devolving upon the said Institute are as follows —

A) The encouragement and promotion of scientific researches and experiments having as their objects a thorough acquaintance with the diseases and pests of cultivated and wild plants, together with the best means for their control

To this end the Institute is required to : —

1) Carry out researches on the action of plant or animal parasites upon plants, and on the pathological changes that ensue.

2) Carry out researches on non parasitic diseases, and on cases of teratology.

3) Study experimentally the immunity or resistance of agricultural plants to their parasites.

4) Study the microbiology of the soil in connection with plant life and growth.

5) Encourage the study of control measures, and experiments in combating diseases, to test insecticidal and fungicidal materials. To answer the questions asked by Associations or private individuals, to take every means of making known the results obtained etc.

6) Establish advanced and special courses of study in matters connected with the objects of the Institute.

7) Inspect and control the importation and exportation of plants, and parts of plants, fruits, seeds, tubers, bulbs, etc.

B) The Agricultural Colleges, Experiment Stations and all similar Institutions and Services under the control of the Ministry of Agriculture, or subsidised by the Federal Government, shall collaborate with the new service.

C) The Biological Institute for the Protection of Agriculture shall include the following services —

1) Service of Plant Pathology

2) Service of Agricultural Entomology.

3) Service of the Selection of Immune or Resistant, Plants.
4) Sanitary Service of Plant Inspection.
5) Laboratory of Soil Microbiology.
6) Demonstration and Experiment Field.

The decree is accompanied by the regulations of the Institute, with detailed information regarding the work of the different services, the staff, and the publications, of the Institute, as well as a complete account of the significance and importance of the new Institution.

443 - **Decree of the Minister of Agriculture Authorising the Importation into Italy of Living Plants, Parts of Plants, Seeds, and other Plant Products.** — *Gazzetta ufficiale del Regno d'Italia*, year 1921, No , 7, pp. 331-332, Rome, March 25, 1921.

With the view of providing the supervision of the importation of living plants, parts of plants, seeds, and other plant products, with the organisation required by the resumption of trade, the Italian Minister of Agriculture has decreed under date of February 21, 1921. —

Art. 1. — The importation from abroad of living plants, parts of plants, seeds, or other plant products, intended for cultivation, or reproduction, must be effected though the Customs Offices of Turin, Milan, Verona, Udine, Venice, Ventimiglia, Genoa, Leghorn, Rome, Naples, Catania, Syracuse, Palermo, Cagliari, Brindisi, and Tarento

Art. 2. — Should packages containing such plants, or portions of plants, be presented at other Customs offices, they are to be refused. They may, however, be dispatched to the nearest of the Customs offices mentioned in Art. 1. if the persons interested intimate to the Customs Authorities their willingness to defray the extra cost of carriage thereby. entailed.

Art. 3. — The cases mentioned in the preceding articles, on arrival at one of the customs offices enumerated in Art. 1., are allowed to be imported after examination by a special Phytopathological Delegate nominated to the local customs Authorities by the Minister of Agriculture, without prejudice to the provisions of Art. 18 of the regulation of March 12, 1916, No. 723 (1).

Art. 4. — If permission is given for the importation of the packages, the necessary precautions prescribed by Arts. 18, 20 and 21 of the regulation of March 12, 1916, No. 723 are taken by the special Delegate, at the expense of the persons interested.

Art. 5. — Citrus trees, or portion of such trees, with the exception of their fruits, no matter whence they have come, which after the examination of the Phytopathological Delegate prove to be free from parasites, are permitted to be imported, but have to undergo a period of quarantine according to Art. 20 of the regulation of March 1916, No 723.

Art. 6. — The provisions of Art. 5 are applicable to fruit trees or portions thereof, with the exception of the fruits, coming from Canada, the United States of America, Chili, the Hawaian Isles, Japan, China, and Australia.

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(1) This is a regulation relating to the carrying out of the provision of the law, No. 888 under date of June 26, 1913 for the prevention and control of plant diseases. Cf. INTERN. INSTITUT OF AGRIC, *Annuaire international de législation agricole*, Year VI (1916), pp. 875-887. Rome, 1917 (*Ed*)

Art. 7. — The seeds of forage plants may be imported, provided they have been found to be free from any species of *Cuscuta*. This must be ascertained by the Phytopathological Delegate himself, or by an authorised Seed Central Laboratory, utilising a sample taken by the said Delegate. The expenses of carriage and of analysis are charged to the interested persons.

Art. 8. — The importation is suspended of the following plants, or parts of plants· —

(*a*) Cuttings and rooted cuttings of European or American vines coming from France, Spain, the United States and Canada in view of their possible infection with black-rot of the grape (*Guignardia Bidwellii*), without prejudice to the antiphylloxera regulations in force.

(*b*) Plants, bark, or decorticated branches and stems of chestnuts from the United States, as a precaution against American canker (*Endothia parasitica*).

(*c*) Fresh fruits from all the following States . — Canada, United States, Chili, Hawaian Isles, Japan, China, Australia, as a precaution against San José scale (*Aonidiella perniciosa*), *Laspeyresia molesta* and foreign fruit fleas.

(*d*) Citrus fruits from all foreign countries as a precaution against the citrus scale (*Lepidosaphes gloverii*, and the white fly (*Aleyrodes citri*).

(*e*) Potato tubers, the fruits and green parts of Solanaceae (tomatos, egg-fruit plants, capsicums, etc.) from all foreign countries as a precaution against black scab of potato (*Synchytrium endobioticum*, *Phthorimaea operculella*, and the American beetles *Doriphora decemlineata* and *Epitrix cucumeris*.

Art. 9. — The preceding provisions do not apply to importations made at the instance of the Ministry of Agriculture.

Art. 10. — Plant products intended for food and for industrial purposes with the exception of those mentioned in Art. 8., are allowed to pass by all the customs offices, without prejudice to the provisions of Art. 17 of the by-law of March 12, 1916, No 723.

Art 11. — The decrees of the Ministry of Agriculture under date of April 25, 1917 and July 12, 1917, are abrogated (1).

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

444 - **Origin of *Puccinia Pittieriana*, Rust Injurious to Potato in Costa Rica, and to Potato and Tomato in Ecuador.** — ARTHUR, J C, in *Science*, New Series, Vol. VIII, No. 1367, pp. 228-229 Lancaster, Pa, March 11, 1921

In 1920 the author called attention to the threatened introduction into the United States of two rust diseases, *Puccinia Pittieriana* and *P.*

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(1) See *R*, July, 1917, No. 670, and *R.*, Sept, 1917. No 865. (*Ed*).

Arachidis, the former attacks potatoes and tomatoes and the second the peanut (1). Since then the latter fungus has been found in one field in Florida where all vestige of it was immediately destroyed.

In 1918, *P. Pittieriana* was very abundant in the experiment station grounds at Ambato (Ecuador) and was not only harmful to potatoes but even more so to tomatoes. This was the first report of the rust in South America, having previously been known only on the highlands of Costa Rica on the potato alone. In Ecuador it showed decided preference for North American varieties of tomato.

In January 1920, A. Pachano, (Ambato Station botanist) who makes a special study of the rust question, stated that the parasite was introduced into Ecuador from the United States.

According to later information from the same authority, the disease was not so prevalent during 1919 as it was is 1918, but had the same relative predominance on the tomato, especially on the North American varieties. He also modifies his views regarding its origin. The author considers that the susceptibility of North American varieties has no special significance with reference to the question of native host or habitat. It may safely be assumed that appearance of the potato rust in the gardens of central Ecuador indicates that it may be found on uncultivated native plants in that same region. The Solanum rusts of tropical and semitropical America are numerous, but have been little studied, and those of Ecuador hardly at all.

There is a rust reported from Colombia on *Sarache edulis*, a close relative of Solanum, which much resembles the potato rust except that it has slightly larger spores. This same rust on another species of *Sarache* was found close by *P. Pittieriana* on Mt. Irazú (Costa Rica) by E. W. D. Holway, who notified the author that this plant known as "yerba mora" is common in the gardens there. There is also very similar rust found on the wild *Solanum triquetrum*, ranging southward from central Texas into the adjacent region of Mexico; this form however, has slightly smaller spores than *P. Pittieriana*. Only actual trial can prove if these forms can be transferred from one host to another, and if the size of the spores is in any way dependent upon the host.

A variation in spore-size apparently dependent on the host is found to occur in the cases of other species. The spores from *P. Pittieriana* are remarkably uniform in size. Whether the three forms of Solanaceous rusts here refered to are the same or not, it is fairly safe to assume that *P Pittieriana* originated somewhere between Ecuador and Costa Rica on hosts native to the localities.

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(1) See *R.*, July-Aug., 1920, No. 813 (*Ed*)

445 - Influence of Temperature and Humidity on the Growth of *Pseudomonas Citri* and its Host Plants and on Infection and Development of the Disease (1).—

PELTIER G. L, (Alabama Agricultural Experiment Station, in *Journal of Agricultural Research*, Vol. XX, No 6, pp 447-506, figs 1, tables 21, bibliogr., of 17 works, Washington D. C. Dec, 15, 1920.

Results of experiment tests undertaken at the Plant Physiology Laboratory, University of Illinois, during the winter season 1918-19 and 1919-20, lasting in all for a period of 8 months.

The minimum temperature for growth in culture of *Pseudomonas citri* Hasse the well known cause of the disease of the Rutaceae termed " Citrus Canker, " is about 5°*C*, the optimum between 20° and 30°, the maximum about 35° for a period of 24 hours, and a thermal death point between 49° and 52°.

The influence of humidity on the viability of the organism is very distinct and is closely associated with temperature. At low temperatures, humidity appears to have little or no influence, while at high temperatures and high humidities, it is the limiting factor At medium humidities at all temperatures, the organism is viable for the period of experiment Some factors or factor other than the rapidity of drying must, therefore, be responsible for these results.

The plants to act as host for *Ps. Citri* during the experiments under glass were: *Poncirus trifoliata* (L.) Raf. Rusk citrange (hybrid between *P. trifoliata* and *Citrus sinensis* Osbeck), and *C. mitis* Blanco. The plants were grown from seed in the Crop Physiology greenhouses at Washington D. C A large number of seedlings of *P. trifoliata* were shipped from Auburn (Alabama).

These plants varied distinctly in their reaction to temperature and humidity, especially at low and high temperatures. However, the optimum temperature for all the plants used was between 20° and 30°*C*. Except for a few slight variations, the same temperature relations hold good in the field.

Three conditions are essential for infection: the presence of free moisture on the plant, a suitable temperature, and an actively growing plant.

The life of the organism in culture and outside the host plant is ruled by an entirely different set of conditions from those which control it when it is parasitically active in the host plant. Likewise, the conditions necessary for initial infection of the plant differ.

The period of initial infection must be clearly distinguished from the period of incubation and subsequent development of the disease.

The conditions which determine the most active growth of the host plant are also responsible for the most rapid development of the disease.

The organism is active in the tissues so long as the host cells are active, and when the plant is forced into dormancy the organism becomes inactive and the disease is then quiescent

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(1) See also *R.* July-Sept 1919, Nos 1038 and 1039 (*Ed.*)

Environmental conditions play an exceedingly important rôle in the susceptibility and resistance of citrus plants to canker.

The results indicate that it will be necessary to study the behaviour of the host plant in its natural surroundings, and its relation to the casual organism before any scientific selection for disease resistance can be made.

446 - **The Influence of Soil Factors in Disease Resistance.** — HOWARD, A. (Imperial Economic Botanist, Pusa, India, in the *Annals of Applied Biology*, vol VII, No. 4, pp. 373-389. figs 5. London, Feb., 1921.

During the last 15 years, opportunities of growing the same crop in India under widely different conditions of soil and climate, and of studying the distribution of the crops have been utilised, and observations on the incidence of disease have been made and of the general conditions which appear to precede serious damage by parasites. An attempt has also been made to ascertain what soil factors are responsible in lowering the natural resistance of a crop to attack. A systematic examination of the root system has been made in every case. The results are here summed up with a view to suggesting the importance of paying much more attention in future investigations of diseases, to the general facts of root development, and to the condition of the absorptive areas of the root system both before the actual advent of the parasite and during the period when the disease is actually established. Up to the present, attention has been paid chiefly to the influence of soil aeration and soil temperature on disease-resistance.

I. *Soil aeration.* — Not only does soil aeration influence the amount of growth, but also the development of the root system and crop resistance to disease, and in some cases actually causes disease. For example, investigations, made with the Java indigo (*Indigofera arrecta* Hochst.) idicated that the wilt disease has no connection with a parasite, but that wilt was produced experimentally in the following ways: — (*a*) By the mutilation of the root system; (*b*) by deep interculture, during the rains, of indigo sown in lines; (*c*) by October and November cultivation of old indigo, dependent for its crude sap on superficial roots which are destroyed by cultivation of the land and encourages wilt. Mulching the surface with straw to preserve moisture and to prevent these roots drying up as the season changes, has the reverse effect; (*d*) by cutting back young rapidly growing August sown plants in October, when the reserve materials in the taproot are insufficient for root regeneration; (*e*) by complete cutting back in cold weather; (*f*) by waterlogging slowly from below during the rains, by closing the drainage opening of lysimeters.

Disease appears to result from damage to the fine roots and nodules under circumstances where root regeneration is difficult or impossible. Wilt generally occurs during the latter half of the rainy season and the agency which may be considered the cause of this effect has been found to be defective soil aeration due to the upward rise of the ground water, combined with the destruction of the porosity of the surface soil by heavy rain which leads to root asphyxiation. Confirmatory evidence that wilt during the rains is due to the destruction of the fine roots and nodules caused by poor soil aeration has been obtained in several directions. Observations have also been made with *Hibiscus cannabinus* L. and sann (*Crotalaria juncea*), where deep rooted varieties are commonly addicted to wilt, but the shallow rooted types are affected to a negligible extent. The surface rooted species like *Hibiscus Sabdariffa* L. thrive, even if the soil occasionally becomes waterlogged.

It is evident from these observations that no parasite appears to be involved in any of the cases mentioned.

In connection with the wilt disease of indigo and of *H cannabinus*, observations were also, made on the conditions which appear to precede the attacks ot two insects *Psylla isitis* Buckt on indigo, and the red cotton bug (*Dysdercus cingulatus*) Fabr. on the latter. It is has been frequently observed at Pusa that applications of fresh undecayed organic manure applied shortly before sowing, as well as oil cake dressings after sowing are always followed by severe attacks of *Psylla*, and in all cases examined root discolouration precedes and accompanies insect attack. A change in the cell sap arising from root damage apparently prepared the way for the red cotton bug on *H. cannabinus*.

The author also studied the rusts of wheat and linseed, and discovered that several of the most rust resistant wheats at Pusa are very shallow rooted in comparison with the deep rooted types liable to disease The same holds good with the linseed, and in this case the shallow rooted types are turgid, white, and exceedingly vigorous and the deep rooted starved and much discoloured. Further observations of the red rot (*Colletotrichum falcatum* Went), of sugar cane leads the author to state that the poor physical texture of black soils appears to render this crop very susceptible to red rot and that soil aeration and healthy root development confer a high degree of immunity on the sugar cane

Experiments conducted in connection with green fly (*Aphides*) on fruit trees showed that there is a definite relation between winter irrigation and green fly, and that the control of greenfly must be sought elsewhere than in the destruction of the insect. The insect can only attack trees in an abnormal condition, and recognition of this fact should be an encouragement to undertake more detailed investigations of the soil, root system and ot the sap of trees affected by green fly.

II. *Soil Temperature.* — Although soil temperature is such an important factor in the distribution of crops in India, both as regards season and areas covered, little attention has previously been paid to this growth factor in considering the occurrence of disease.

One of the difficulties in wheat cultivation in Bihar and the eastern districts of the United Provinces is to establish the crop, and early sowings were in every case destroyed by Termites, while in the later ones the damage was negligible and normal root development and growth took place. The author attributes this to the fall in the soil temperature during the second half of October as Termites were found feeding on a set of seedlings which had been practically destroyed by soil temperature above the maximum for growth. Examination of the root system provided the clue which soon led to the discovery of the cause of the trouble, and the remedy worked out has since been widely adopted on the indigo estates of this tract.

The einkorn (*Triticum monococcum vulgare* Kche.) is well known to be very resistant to the attacks of black rust (*Puccinia graminis* Pers.). In 1907, a plot of this wheat was grown at Pusa when it was found to be immune to all three species of rust which occur in N. E. India. The plants were however still in the vegetative condition at harvest time and were allowed to grow during the hot weather to see if any ears would form. No change of this kind took place, but early in May they were found to be severely attacked by *P. graminis* It should be noted that a prolonged rise of temperature led to a complete loss of disease resistance in a species considered to be immune to this fungus.

Many more examples of disease resistance in other parts of the world must however be examined before it can be definitely stated as to how far immunity depends on morphological root fitness for the environment, and how far it is inherent in the natural resistance of the protoplasm to the invasion of a parasite.

447 - **Rust Resistant Varieties of Oats, in the United States.** — See No, 376, of this *Review*.

448 - **Resistance of Beans to Certain Diseases in New York State.** — See No. 377, of this *Review*.

449 - **Fungicidal Dusts for Control of Wheat Smut (*Tilletia Tritici*).** — MACKIE, W. W., and BRIGGS, F. N, in *Science*, new series, Vol. LII, No 1353, pp. 540-541. Lancaster, Pa. Dec., 1920.

Results of using copper sulphate dust in the control of bunt (*Tilletia Tritici*) at Berkeley (California).

The partial success obtained by using flowers of sulphur as a means of prevention in California, and the reported success obtained with copper carbonate (1) in New South Wales encouraged new attempts at dust treatments.

Little Club wheat dusted with spores of *T. Tritici* at the rate of 1 pt. of spores to 750 pts. of seed by weight, and treated according to standard formulas, gave the following results shown in Table.

Sowings were made in rows on the rod-row system on March 8, 1920, and later, which accounts for the somewhat light smut attack. After the grain was threshed, considerable injury to the seed coats was observed permitting maximum copper sulphate injury.

The tests were replicated from 2 to 9 times and the average tabulated.

The results from the various tests demonstrate the effectiveness of copper sulphate dust when mixed with equal parts of calcium carbonated dust, in the control of bunt attack due to seed borne spores. No damage to seed germination occurred. Copper carbonate dust was equally

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(1) See *R* April 1920 No 469 (*Ed*)

Fungicide	Treatment		Smutted plants	Smutted heads
	Strength	Germination %	%	%
Control	—	99.0	12.8	6.2
Formaldehyd	1–40	98.0	0.	0.
Copper sulphate	1–4	12.5	0.	0.
Copper sulphate	1–4	—	—	—
Copper sulphate + lime solution	1–8	80.0	1.7	0.4
Copper carbonate	dust	95.3	0.	0.
Copper sulphate	»	54.1	0.	0.
Copper sulphate dust mixed with calcium carbonate dust (1 — 1)	»	98.3	0.	0.
Copper sulphate and lime dusted separately	»	96.5	0.	0.

effective. These dusts, especially the copper sulphate, adhered closely and completely covered all parts of the seed wheat. The process of shaking the wheat in dusting removed a large portion of the bunt spores. Two ounces of the dusts per bushel are considered ample. Further experimentation is, however, desirable before the dust methods are put into general practice.

450 – **Diseases and Insect Pests of the Cotton Plant in U. S. A.** — See No. 388 of this *Review*.

451 – ***Cephaleuros mycoidea* and *Pestalozzia Hartigii* Parasites on Tea Plants in Ceylon.** — See No. 393, of this *Review*.

452 – **Plant and Animal Parasites Found on some Medicinal and Essential-Oil Plants in Italy.** — PARISI, R., in the *Rivista di Patologia vegetale*, year XI, Nos. 1-2, pp. 1-16. Pavia, March, 1921.

Prof. F. CAVARA, Director of the Royal Botanic Gardens of Naples, found upon certain medicinal and perfume plants that are largely cultivated in those gardens, several parasites (both plant and animal), which he sent to the author for examination and study.

The plant parasites enumerated are as follows: —

(1) *Physoderma Debeauxii* Bubák, on the leaves of *Scilla maritima*; very injurious to this plant.

(2) *Uromyces Rumicis* (Schum.) Winter, on the leaves of *Rumex Patientia*.

(3) *Phragmidium subcorticium* (Schr.) Wint., on the leaves of *Rosa centifolia*.

(4) *Thielavia basicola* (B. and Br.) Zopf., on young plants of *Atropa Belladonna*, in the propagation green-houses; the fungus had not before been met with on this Solanacea; in 1920, it destroyed 90 % of the young plants in a few days.

(5) *Ramularia variabilis* Fuck., on the leaves of *Digitalis purpurea*; the parasite attacks all varieties of this plant; the least susceptible is

the Sardinian *tomentosa* variety. According to Prof. CAVARA, experiments carried out have shown that the fungus has a considerable influence upon the elaboration of the active principle of the plant.

(6) *Heterosporium gracile* (Wallr) Sacc. on the leaves of *Iris pallida.*

(7) *Macrosporium Papaveris* n. sp., on the young green capsules, of *Papaver somniferum*, var. with white seeds, the author here gives, in Latin, the description of the new micromycete.

(8) *Macr. Cavarae* n. sp., on the leaves, even the cotyledons, of many varieties of *Ricinus communis.* The author describes this species and from what he observed, the plantations of castor plants that had been manured with calcium cyanamide had suffered most from the attacks of this parasite.

(9) *Macr. Solani* Ell. and Mart., on the leaves of *Hyoscyamus albus H. niger,* and *Atropa Bellandonna,* as well as on the leaves and fruits of *Datura Stramonium, D. Metel,* and *D. fastuosa.*

(10) *Pleospora Melissae* (Desm) Parisi on the leaves of *Melissa Officinalis.*

The author mentions the following animal parasites: —

(1) *Heterodera radicicola* Greef, in the root-system of *Althaea officinalis.*

(2) *Chrysomphalus dictyospermi* (Morg.) Leon. on the leaves of some five-year-old specimes of *Cinnamon Camphora.*

(3) *Aulacaspis rosae* (Bché) Chell, on the stems of *Althaea officinalis.*

(4) *Icerya purchasi* Mask, on a single hybrid specimen of " Rose de l'Häy. "

453 -**Wart Disease of Potato (*Synchytrium endobioticum*) also attacks Tomato Plants, in Pennsylvania** (1). — *Weekly News Letter*, Vol. VIII, No. 30, p. 3. Washington, Feb, 23, 1921.

Recent investigations made by the United States Department of Agriculture on the control of the potato wart disease (*Synchytrium endobioticum* (Schilb) Perc, = *Chrysophlyctis endobiotica* Sch lb.), a European trouble found in North America in 1918, disclosed the fact that this disease also attacks tomatoes. Out of 28 varieties of tomatoes planted in the wart-infested gardens of the eastern Pennsylvania, 26 were found to be susceptible to the disease.

It is at present known to be in confined to gardens in a few mining villages in Pennsylvania, West Virginia and Maryland. The disease attacks only the stems and roots of the plant, causing the formation of small warts; it probably does not reduce the yield of fruit.

The importance of the discovery of the susceptibility of tomatoes to potato wart lies in the fact that affected tomato plants will serve to carry the disease over from year to year in the absence of potatoes, and to introduce it into new localities through the transplanting of tomato seedlings grown in infested soil. It is not yet definitely known whether all varieties of tomato are susceptible to wart disease, but it is feared that such may be the case. Other plants belonging to the Solanaceae are suspected of being susceptible to wart and some have already been tested, but with inconclusive results; the tests, will for this reason, be repeated.

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(1) See *R*, April, 1919, No. 536. (*Ed*)

454 - **Onion Smut (*Urocystis Cepulae*) in England** (1). — *Ministry of Agriculture and Fisheries*, Leaftet No. 365, pp.-1-6, figs, 2, London, Feb., 1921.

The attacks in England of Onion Smut (*Urocystis Cepulae*) are confined at present to five centres. They occur in strictly localised areas in the following localities: near Northampton, St Neots and Kendal, and in market gardens in two districts in Northumberland.

A description of the disease, method of infection and means of control are here given .

Leeks are, if anything, even more susceptible to smut than onions, so that the cultivation of this crop, and also of shallots, should be confined to soil free from contamination.

The application of a solution of formaldehyde to the drills at the time of sowing, has, however, proved very effective. The Ministry of Agriculture in London is carrying out trials with this substance in the hope of being able to recommend a simple and satisfactory method of treatment.

Onion smut was scheduled in 1920 under the Destructive Insect and Pests Act. Under the Order no person is allowed to sow onion seed in the locality declared by the Ministry to be an " infected place ". Onion plants grown in an infected place may not be removed until the plants have been inspected whilst growing, by an Inspector of the Ministry and certified by him to be free from smut, and have been washed free from soil. Any person in charge of land on which onion smut exists must notify the fact to the Ministry or to an Inspector of the Ministry. If smut is found to exist in any subsequent year, a futher notification of disease must be given. Any person failing to comply with the requirements of this Order is liable to a penalty not exceeding ten pounds (sterling).

455 - **Septoria Iridis, a Spherioidea Injurious to the Iris in Latium.** — COLIZZA, C., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, No. 12, pp. 494-504, 2 figs., 1 plate. Modena, 1920.

A fungoid disease of which little is so far known, attacks plants of *Iris florentina* and *I. germanica* in many parts of the Communes of Marino, Grottaferrata, and Albano.

When first infected, the leaves of the diseased plants have on their surface a few, dry, round areas surrounded by a lighther halo. Gradually the number of these spots increases, and the patches tend to extend in a longitudinal direction, and finally assume an elliptical shape. They are often striated, especially when the plants grow in damp localities. The spots increase in number and size, so that finally the leaves wither very rapidly. When the disease is far developed, the lower leaves of the plants wither entirely, and the others are more or less covered with spots. Those on the flower-stalk at once assume an elongated form, and the epidermis and also the cells beneath the spots are completely destroyed by a micro-organism, which, however, is in no way connected with the agent of the disease in question. The plants wither most in the summer; in the spring the disease passes almost unnoticed, as the leaves are young. When the malady has attained an advanced stage, that is to say, as soon as the spots begin to assume an opaque brown colour, small bodies appear which are first yellow and become gradually darker, till they are at length deep yellow. These are the fructification (pycnidia) of a spherioidea considered by the author as the cause of the disease, and which he identifies as *Septoria Iridis* Massal.

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(1) See *R.* June 1919 No 792. (*Ed.*).

The disease is most commonly met with on plants growing in damp soil and very close together; if thickly planted, the disease also appears, even on dry soils. Under similar conditions, thick clumps of iris are more exposed to the malady than plants growing some distance apart. The greatest injury is to be observed where the soil is rich in organic matter, and where the potash content is insufficient for the requirements of the plants. Artificial infection experiments have proved that the disease spreads without there being any lesions in the epidermis, for the germinating micelium penetrates into the interior of the parenchyma of the leaves and flower-stalks through the openings of the stomata.

As regards the control of the disease, in order to prevent it, or at any rate lessen it as much as possible, the irises must be thinned out every year, and all dry parts or green leaves that show the spots characteristic of the different stages of infection should be removed and burnt, as the spores of the parasite are very long-lived.

It is also advisable to examine the plants from time to time, when first they put forth their leaves, in order that any of the latter which show signs of the disease may at once be removed. Great attention must be paid to the drainage of the beds, and the plants should be liberally supplied with fertilisers containing potash lime and phosphates. The fungicides that give the best results are those consisting of salts of copper and iron, but they are only useful as preventive measures.

456 - ***Botrytis galanthina*** **Mould Injurious to** ***Galanthus*** **spp. in England.** — ARNOT S., in *The Gardener's Chronicle*, Vol. LXIX, No. 1780, figs. 1. London, Feb., 5, 1921.

The author states that after many years experience he has noticed that a mild season, or one with frequent alternations of wet weather and frost, in the time when the fungus (*Botrytis galanthina*) seems to appear most frequently and to be most virulent on the snowdrop plants (*Galanthus* spp.).

The fungus is not difficult to detect if the plants are examined closely. The first appearance consist in a greyish mould around the plant just at the surface of the soil. This mould spreads until the whole, or nearly all the leaves and flowers are covered, should the stem not collapse before that happens. The author does not consider that it is possible to cure each individual plant attacked, as the disease comes from below and the bulbs are badly affected also. He recommends instead, the caraful lifting of the plant and burning it. This should, if possible, be done as soon as the fungus is detected.

It is probable that by spraying the unaffected plants with a fungicide, the spread of the disease might be checked. The author has found that with timely removal of affected bulbs, if supplemented by a dressing of flowers of sulphur on the soil, the disease did not reappear, either in that or the following season on the same groups.

The fungus is not restricted to plants in gardens but has also been observed on those plants which have been naturalised for generations in grass and especially under trees. The author has never seen the disease on *Gal. plicatus*.

In addition to burning the diseased plant it is advised also to burn some of the surface soil round about it and also that which is in contact with the roots and bulb.

457 – **A Bacteriosis of the Ivy Observed in France.** — KILLIAN C., in the *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXIV, No 4, pp. 224-226. Paris, 1921.

LINDAU was the first to describe, in 1904, under the name of "Efeukrebs" (ivy canker), a disease of the ivy which he attributed to bacterial agency, without, however, giving any experimental proof of this assertion. In 1920 ARNAUD added some details to this descriptive study.

In 1916, the author succeeded in isolating the pathogenetic agent and reproducing the disease experimentally, at the Botanical Institute of the University of Strasburg. The micro-organism was isolated from recent lesions, those in the interior of the tissues being selected. Small pieces of pith from the stem were placed in suspension in an infusion of ivy of which some drops had been placed on ivy gelatine. Amongst the colonies thus obtained one species of bacillus was clearly predominant; the author describes its cultural and morphological characters, but does not give its name.

Pure cultures were made during the months of July, August and September under the following conditions:—

(1) Fifty young plants, of erect or climbing habit, were inoculated by punctures made in both adult and young organs, and were kept, for the most part, in a damp atmosphere. The younger portions soon showed the blackening, characteristic of the disease; the adult parts, however, remained completely unaffected; (2) some young control plants punctured with sterilised instruments remained immune; (3) twenty young plants cultivated in pots were successfully inoculated. Thus, cuttings appear to be more susceptible than older plants to the disease.

The bacillus found later in the lesons was compared and identified with that employed in the inoculations.

If the young inoculated plants are kept in an ordinary atmosphere, they show no signs of the disease until after the third week; in a damp greenhouse, however, the black discoloration appears at the end of the first week. The dark patches increase in size rapidly (spreading as much as 1 cm. a day). . They pass from the stem to the petiole, and then to the lamina. The young soft portions of the plant usually succumb when attacked, but the adult parts are more resistant: it often happens that the course of the lesions which have spread rapidly during the first week is afterwards arrested. The greater the age of the stem, the more likelihood is there of its recovery. This is due to the structure of the tissues, as has been proved by the anatomical study of both natural, and artificial lesions In the diseased leaf the centre of infection is easily recognised, it consists of hypertrophied cells that project, raising the epidermis. Around this centre of infection, which is crowded with bacilli, there is a wide zone of dead cells, that pass insensibly into the normal tissues, and are wholly free from micro-organism In the case of young leaves which have been infested from a very early stage, the centre of infection contains no cells, but consists of a large circular cavity full of bacilli, so that there is no spreading of the disease from a central point, such as occurs in the adult portions of the plant.

In the above-mentioned cases, the leaf is probably infected from without, but the disease can also spread internally. When introduced into the stem, the bacilli after having infected the petiole, make their way chiefly along the veins. This is also the usual manner in which they spread through the stem. At first, the parasites are only present in small numbers in the cortex, but they soon multiply there, and destroy the cortical tissues. The walls of the cells being absorbed, leave the way clear for the invasion of the neighbouring cells. Thus, rows of infected cells are formed in the midst of the normal tissues. The latter, when in contact with diseased cells are especially rich in oxalate of calcium and starch. The bacilli collect by preference in elongated cells in the vessels, and generally choose the sieve-tubes, where they develop best. The vascular tissue thus can be infested with bacilli, while the cortex is completely free from them. The bacilli in the stem, following the lines of least resistance, take a longitudinal course, whereas in the leaf, they spread in all directions. On account of the more solid structure of the stem, the progress of the parasites is retarded.

Very frequently, the host gets the upper hand, in which case, wound-callus is formed round the centre of infection, as has been described by LINDAU.

458 - **Disease and Insect Pests of Citrons in Tunis.** — See No. 395 of this *Review*.

459 - ***Fusarium cubense*, Hyphomycete Injurious to Banana in the Philippines.** — LEE, H A , and SERRANO, F. B., in *The Philippine Agricultural Review*, Vol. XIII, No 2, pp 128-129. Manila, 1920.

Plants of the Latundan variety of the banana (*Musa sapientum*) have been observed with banana wilt at Los Banôs and Calamba in Laguna Province, and San Luis, Lemery and Taal in Batangas Province.

According to the investigations made by BRANDES in Porto Rico, the disease is due to the fungus *Fusarium cubense* E. F. SMITH.

The authors have isolated a species of *Fusarium* uniformly from the affected plants in Laguna, which agrees closely with the description of *F. cubense*. The fungus was inoculated with a needle into the pseudostems of healthy banana plants, and the characteristic discolouration was obtained, which is typical of banana wilt. Inoculations with a needle without the fungus have given negative results.

The authors state, that up till now the Latunda variety has in their experience been the only variety susceptible. Other varieties equally desirable also exist which are apparently resistant. Prevention of this disease will therefore be based upon the distribution of resistant varieties to affected localities.

Results from inoculations with *F. cubense* upon abaca plants (*M. textilis*) indicate that the latter is resistant to this disease.

WEEDS AND PARASITIC FLOWERING PLANTS

460 – ***Clathrosorus Campanulae*** **n. gen. and n. sp. of Plasmodiophoraceae, Parasitic on the Weed** ***Campanula rapunculoides*****, in Denmark.** — FERDINANDSEN, C., and WINGE, O., in *Annals of Botany*, Vol. XXXIV, No. 136, pp. 467-469, pl. 1. London, Oct., 1920.

In 1918 in a garden in Sorö, Sealand (Denmark), numerous small swellings, resembling to a certain extent the bacterial tubers of leguminous plants, were observed on the roots of roguing bluebells (*Campanula rapunculoides*).

The authors were able to ascertain that these swellings were due to a parasitic Plasmodiophoraceae sp., evidently a representing a new genus and a new species which has been designated with the name of *Clathrosorus Campanulae*.

Only the cortex is infected.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

461 – **The Effective Control of the Scale Insect, *Icerya purchasi* by the Coleopteron *Novius cardinalis* in the Oasis of Tripoli.** — LEONE, G., in *L'Agricoltura Coloniale*, year XV, No. 3, pp 140-141. Florence, March, 1921.

For some years past, individuals of *Icerya purchasi* have been observed on various plants in the oasis of Tripoli. In the spring of 1920, there was for a few days a regular invasion of these insects, which threatened to destroy whole plantations of citrus trees in Menscia.

The agriculturists sprayed the plants attacked with different poisonous solutions, but without any satisfactory results.

Thanks to the interest taken in the matter at the Laboratory of General and Agricultural Zoology of the Royal Agricultural College at Portici, the author was able, in July, 1920, to obtain, and transport to Tripoli about 100 individuals of the coccinellid *Novius cardinalis;* these he set free in the citrus plantations infested by the scale insect. Some months later, the coleopteron had already multiplied to a large extent, and the violence of the attack of the scale insects was arrested.

The agriculturists themselves, both colonists and natives, new do all they can to encourage the propagation of *Novius cardinalis;* they take individuals that have hatched out in Tripoli, and set them free in the citrus plantations where *Icerya purchasi* is still to be found.

462 - **Experiments on the Toxic Action of Certain Gases on Insects, Seeds and Fungi.** — NIEFERT, I E., (Insecticide and Fungicide Laboratory. Bureau of Chemistry) and GARRISON, G. L., (Cotton Entomologist, Bureau of Entomology) in *United States Department of Agriculture,* Bulletin No. 893. pp. 1-16. Washington D. C. 1920.

Report of experiments made to test the action of certain toxic gases and to determine the value of these gases for fumigating purposes. The Bureau of Entomology of the United States in co-operation with the Chemical Warfare Service of the United States War Department made experiments on the action of toxic gases upon the body louse(*Pediculus corporis* De G). Nearly 800 fumigations, in which 20 000 insects of about 15 different species were trated, took place. The results obtained as shown in the appended tables, lead to the following conclusions: —

Phosgene ($COCl_2$) is not useful as an insecticide because of its toxicity towards human beings, its high vapour pressure, the difficulty of controlling it, and its comparatively low toxicity toward insects; neither does it possess any value as a fungicide.

Arsine ($As\ H_3$) has no advantage other than the ease of generation and possesses many disadvantages as an insecticide. Its toxicity towards insects is comparatively low, it is injurious to plants, and has no effect on fungi.

Illuminating gas in concentrations up to 3 % and for exposures up to 2 hours is not toxic to insects. Carbon monoxide in concentration up to 3 % and for exposures of 2 hours is also not toxic.

Of the gases tested, cyanogen chloride and chloropicrin give promise of being useful for fumigation purposes. Neither of these, however, can be used in greenhouse fumigation, because of their injurious action on plants. Nevertheless they probably can be used in the fumigation of stored products.

The efficiency of chloropicrin as an insecticide is undoubted and in general, it is more poisonous to stored product insects than hydrocyanic acid. Other advantages which it possesses are ease of detection, and non-inflammability; its disadvantages are its adherent quality, which makes it necessary to air the material for some time after it has been fumigated, its corrosive action on metals, its severe lachrymal effect, and its low volatility. This last objection may be partially overcome by pouring the dose required on paper, thereby increasing the evaporating surface.

As an insecticide, the effect of cyanogen chloride is practically the same as that of hydrocyanic acid. Its disadvantages are its injurious effect on plant life, low boiling point, slighly corrosive action on metal and severe lachrymosal effect; it advantages are that it is active as a fumigant, is easily detected, is not injurious to seeds in doses which a toxic to insects and fungi, and is no more toxic toward human beings than hydrocyanic acid. It is safer to use than the latter because it can be detected in lower concentrations.

More experiments on the fungicidal aspect are necessary to work out in greater detail the methods of its use. Since it is a dry gas and does not injure the seeds, its use would offer a decided advantage over the present method of treatment for fungi, whereby the seeds are moistened, which sometimes causes germination before it is deisred.

463 - **Rice Weevil (Calandra) *Sitophilus oryza* in the United States, especially in Florida.** — Cotton, R. T., in *Journal of Agricultural Research.* Vol. XX, No. 6, pp. 409-422, pl. 1, Bibliogr, of 9 works, Washington D. C. Dec., 15, 1920.

Since the middle of the XVIIIth Century, when it was discovered in Europe, *Sitophilus oryza* has everywhere attracted the attention of scientists which has given rise to extensive literature relative to this weevil It is thought to have originated in India and to have been conveyed to Europe. through commercial transport. At present it is perhaps the most widely distributed of known insects where grain is used. In North America, it is reported from Florida to Alaska, but it is found to be most abundant in the South Atlantic and Gulf States.

The losses at the present time are particularly severe in India, Mexico, South America, and other tropical countries where the weather conditions are such that the weevil can breed unchecked throughout the entire year. Loss is occasioned by both the larvae and adult beetles. The feeding of the larvae is confined chiefly to the seeds of common grains, but the adults feed on a great variety of seeds, fruits, and other food stuffs. In addition to the loss in weight caused by the feeding of the larvae and weevils, infested grain is often rendered unfit for consumption and has a poor germinating capacity.

The author reports the results of observations made in Orlando (Fla.) during the year 1919 and the early part of 1920 on weevils breeding in maize; a description of the various stages in the life history is also given.

The parasites of *S. oryza* are numerous and attack all stages of this insect. A predaceous mite, *Pediculoides ventricosus* Newport, in often found in weevil-infested maize in the Southern States and attacks and kills eggs, larvae and pupae of *S. oryza*. Two hymenopterous parasites, *Cercocephala elegans* Westwood and *Aplastomorpha vandinei* Tucker, are found in large quantities in Florida. In addition to the above mentioned parasites other parasites and predaceous insects are reported not only in the United States, but also in Australia and India. Of the vast number of remedies that have been advocated for the control of this weevil, the most effective agents now known are carbon disulphide and heat.

464 - ***Laspeyresia novimundi* n. sp., Microlepidopteron Injurious to Garden and Field Peas in Wisconsin.** — Heinrich, C., in *The Canadian Entomologist*, Vol. LII, No. 11, pp. 257-258, figs 2. London , 1920.

Morphological description of *Laspeyresia novimundi* as a new species, found in Sturgeon Bay Wisconsin, parasitic on Garden and field peas

(*Pisum sativum* and *P. arvense*). Eight moths have been reared by C. L. FLUKE from larvae feeding in the pods of the foodplants. The adults made their appearance in July

This is the species identified by FERNALD as the European Pea Moth (*L. nigricana* Stephens) and has so figured in Canadian literature. It was first reported in Canada as destructive to peas and under the name *L. nigricana* Steph. has appeared in several American publications. The author is, however, now convinced that this pea moth in Wisconsin is neither *L. nigricana* nor any of the other European *Laspeyresia*.

If *L. novimundi* is not a native species that has passed over to the pea from some wild legume, it has probably been introduced from the Orient. In any case the name *nigricana* does not apply to the insect in question and should be eliminated from the Canadian lists.

465 – ***Cereplastes sinensis*, a Scale Insect Injurious to Citrus Trees and Other Cultivated Plants in Italy and France.** — SILVESTRI, F, in the *Bollettino del Laboratorio zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol XIV, pp. 3-17, 10 fig, Portici, 1920.

Ceroplastes sinensis Del Guercio was seen for the first time in Liguria, on citrus trees, especially on the "chinotti" (*Citrus sinensis* Risso), and also on some garden plants. The parasite was known in 1900, but was probably introduced into Italy between 1890 and 1896, perhaps with certain ornamental plants of the genus *Muehlenbeckia*. At the present time, it is a common pest in South France. *Ceroplastes sinensis* is probably a native of China.

It 1913, it made its appearance in Naples and Rome, since when it has spread in the southern part of the Province of Naples where it has reached Nocera-Inferiore (Salerno). It has also extended northwards, as for as Maddaloni in the Province of Caserta. The pest has not been reported from Basilicata, Calabria, Sicily, or Sardinia neither has it been found anywhere between Rome and Liguria, or on the Adriatic coast.

The author gives a detailed morphological description of the different stages of the development of the insect, together with an account of its life-history.

The plants on which this scale-insect thrives best are, according to the author's observations: — *Schinus molle, Muehlenbeckia platyclados, Veronica speciosa, V. salicifolia, Chrysanthemum frutescens, Chrys. grandiflorum ;* after which come citrus-trees (the "chinotto," mandarin, orange etc.), *Euonymus japonicus, Spiraea chamaedryfolia, Philadelphus coronarius, Aster formosissimus, Dahlia variabilis*, and *Salvia splendens*. Some authors also mention as host-plants of this parasite, *Gardenia florida, Amaranthus* sp., rose-trees, pear, and apple-trees, but until the contrary has been proved, the presence of *Cer. sinensis* on these last and especially the pear and apple, must be regarded as accidental, and confined perhaps to the early stage of the insect, at which period it is even found on a number of herbaceous plants growing in the vicinity of the infected trees, such as French beans, maize, etc.

It is necessary to bear this fact in mind, so as not to introduce into a district free from this scale-insect, any kitchen-garden or ornamental plants, or shrubs, trees, or portions of the same, that have been grown in an infected place. This is especially to be avoided between July and November.

It is known that the hymenopteron *Scutellista cyanea* is an egg-parasite of *Cer. sinensis*, but it seems to do little damage to its host. Certain coleoptera (*Chilocorus* and *Exochomus*) also attack the newly-hatched larvae, or the small fixed larval individuals, but in such small proportions, that it cannot be said they render a valuable service to agriculture. At Portici some large male larvae were seen to be attacked by a hymenopteron (*Aphicus*).

In its native country, the scale-insect must undoubtedly have one or more natural enemies that control it efficaciously. These should be discovered, studied, and introduced into the infected districts of Europe

466 - ***Tylenchus* sp. Nematode Injurious to the Banana in North Queensland.** — ILLINGWORTH, J. F., in *Queensland Agricultural Journal*, Vol XIV, Pt. 7, pp 297-301, pl. 2. Brisbane, Dec, 1920.

In 1917 a survey was made of the affected banana gardens in the Freshwater area in Cairns and the plants were found to be in a seriously damaged condition All of the lower leaves were either dead or dying, the others were lacking in their usual healthy green colour, the bunches were very much dwarfed.

Digging the plants proved that most of the rootlets were dead or rotted, and the larger roots showed decay in patches particularly at the points where the rootlets had disappeared. The surface of the corm, too, showed brown diseased areas.

Some of the diseased roots were selected and thin cross sections made, cutting through the darkened areas where the roots had rotted off. Examination of these sections under the microscope revealed myriads of Nematode worms (*Tylenchus* sp.) in all phases of development, especially at the point of contact of disease and sound tissue. It is not surprising that these organisms have not been discovered before since there is no apparent enlargement of roots, and after the material is preserved it is difficult to locate the pests and it is mainly the activity of their movements in the tissue of the host that makes them visible.

As regards control measures, recent investigations made by A. H. BENSON has brought into evidence the efficacy of dipping banana plants, prior to planting in a 1 in 1000 solution of corrosive sublimate for 2 hours; no injury was done, even when allowed to remain in the solution longer than the prescribed time. The suckers thus treated were planted at depths of 12, 18 and 24 in. All developed very satisfactorily, those planted at 12 cm, deep made the earliest start; eventually producing the best plants as well as developing the most suckers. So far, no nematodes have been discovered on the roots of any of the treated plants irrespective of the depth of planting

It is also recommended to make experimental trials with arsenic acid.

This should be due by dusting the corms and the holes where they are to be planted, also by mixing the poison with the soil in infested fields, before planting out the sets. Lime, too, may have some value, and should be used at the time of planting.

467 - ***Laspeyresia conicolana*** **a Microlepidopteron Injurious to** ***Pinus Laricio*** **var.** ***tenuifolia*** **in France.** — NÈGRE, M., and PICARD, F., in the *Bulletin de la Société entomologique de France*, No 1 pp 10-12, 1 fig. Paris, 1921.

In the forest of Saint-Guilhem-le-Désert, there has been discovered on *Pinus Laricio* var *tenuifolia*, a tortricide, *Laspeyresia* (*Grapholitha*) *conicolana* Heyl., which is probably new to France; it has hitherto only been found in Holland and Lower Austria, where it attacks the cones of *Pinus sylvestris*.

It 1914, observers noticed for the first time that this insect destroyed many of the seeds of *P. Laricio*, var *tenuifolia*. In 1920, the investigations were resumed, and it was found that the pest was still continuing its destructive work and that most of the pine seeds had been devoured by it.

When reared, the moths appeared in April, or at the beginning of May, that is to say, earlier than in Central Europe, where they emerge from the chrysalis in May or June.

L. conicolana has only one generation. The moths deposit their eggs in spring, the caterpillars hatch out in the summer, hibernate in the larval condition, and do not pupate until the following spring; a fortnight after pupation, the moths emerge Some larvae were found at the beginning of April, as well as many chrysalids. The caterpillars are whitish, their heads being dark brown and not yellowish green with black heads as has been stated. Perhaps they vary in colour, according to their age. The larvae make their way along the axis of the cone, and pupate among the scales. The moths reach the exterior through the free end of the scale, carrying with them the pupal integument which remains attached by the point to the substratum. The cone appears deformed, and much bent. This is due, as careful examination proved, to the insect remaining in the axis during development, and is not, as CALAS supposed, a distictive character of *P. Laricio* var. *tenuifolia*.

In addition to *L. conicolana*, the larvae of a cecidomyid were also found infesting the cones of *P. Laricio*, which they injured to a great extent. No adult forms of this insect have so far been found. They attack the cone soon after its formation, probably in June-July. The puncture causes much resin to exude, which renders the cone turgid, displaces the scales, and makes it deformed. The cone ceases growing, and dries up during the first autumn, or the following spring. In 1914 more than half the young cones of *P. Laricio* var. *tenuifolia* in the forest of Saint-Guilhelm-le-Désert were of the characteristic shape due to the attack of the dipteron, which also injures the fruits of *P. silvestris*: it is very rarely found elsewhere in the locality in question.

[466-467]

ALFREDO RUGGERI, *gerente responsabile.*

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

468 - **Researches on the Bacteria of Certain Kitchen Garden Plants.** — LA CAMERA, P. (R. Istituto Batteriologico della R Scuola Superiore d'Agricoltura in Portici), in *the Bollettino Veterinario Italiano*, Year XVIII, No. 146, pp. 446-447. Turin, February-March, 1921.

The author has examined, from a hygienic point of view, certain kitchen-garden plants which are usually eaten raw, viz., common fennel (*Anethum phoeniculum*), celery (*Apium graveolens*) various kinds of Roman lettuce (*Lactuca sativa*), and endive (*Cichorium Endivia*). The specimens studied were taken, all aseptic precautions being observed, from kitchen-gardens in the vicinity of Naples which had been manured with dirty water, sewerage water, night soil, road-sweepings, and dung.

The author noticed the presence, in every case of 4 species of micro-organisms of which 3 were characteristic: — 1) A bacillus that quickly liquefies gelatin and produces a foetid gas, and which the author proposes to name *B fluidificans foetidus*, or *B. f. putridus*; 2) and 3) two entirely anaerobic non-liquefying bacilli; one of these produces a substance causing fluorescence in the gelatin and imparting an emerald green colour to broth; it also gives off an unpleasant odour. The author is of opinion that the two last-named micro-organisms are forms of *B. fluorescens putridus* The fourth bacillus is a small, innocuous form that is always present in the air, soil, and water.

These 4 kinds of bacteria do no harm to the organism, and appear to reduce the organic matter composing the manures, that is to say, they act as purifiers of the soil; they are saprophytes, and are serious rivals of certain parasitic micro organisms, such as the organisms of anthrax and typhus.

469 – **The Influence of Diet on the Antiscorbutic Potency of Milk.** — I. HART, E. B., STEENBOCK, H., and ELLIS, N. R. (Dept. of Agricultural Chemistry, University of Wisconsin Madison), in *The Journal of Biological Chemistry*, Vol. XLII, No. 3, pp. 383-396, pl. 1,, figs. 14. Baltimore, M. D., July 1920. — II HESS, A. F. UNGER L, and SUPPLÉE, G. C. (Bureau of Laboratories, Dept of Health, N. Y), *Ibid.*, Vol XLV, No. 1, pp 229-235, figs. 2, table 1, bibliogr of 5 works. December, 1920

I — For the purpose of studying restricted ration problems, a herd of 18 cows, all of which were kept yearly on air-dried roughages and grains was maintained. No fresh green vegetable tissue was even fed to the herd.

Results showed that the milk thereby obtained was distinctly inferior in its content of antiscorbutic vitamine to the milk derived from cows receiving a part of their ration as summer pasture, which consisted of fresh green material. The summer pasture milk was derived from cows which, during part of the day grazed on timothy, blue grass and clover land. When used with the basal ration for guinea pigs (a mixture of heated alfalfa hay, finely ground, rolled oats and common salt), 15cc. daily of summer pasture milk per individual afforted protection against scurvy for 20 weeks. However, 50cc. was a safer limit for complete protection. At least 75cc of dry feed milk daily was required per individual for complete protection against scurvy

The winter feeding of dairy cows was in these experiments limited to a ration consisting of grains, mixed hay, a small amount of silage, (10 lb. per day)., and the hybrid sugar mangel (*Beta vulgaris* var.). Silage or sugar mangel milk was classed with dry feed milk and not of the order of green summer pasture milk in respect to its antiscorbutic vitamine There is a certain amount contained therein but this vitamine is too low a content for protection of a guinea pig against scurvy.

II. — The investigations undertaken by HESS, UNGER and SUPPLEE differ from the above mentioned experiments mainly in the delimitation and duration of the feeding periods, and in the inclusion of a chemical examination of the 2 varieties of milk. The cows had been stall-fed throughout the winter on a normal winter ration of ensilage, hay, and concentrates. From the end of April onwards, the diet was selected to provide a food which was ample in all respects excepting in its quota of antiscorbutic vitamine. After 3 weeks of this antiscorbutic free ration. — (25 lb. concentrate mixture consisting of 1 pt. bone meal, 2 pts. oil meal (flaxseed extracted by pressure), 2 pts hominy, 2 pts gluten meal, and 2 pts of bran, 8 lb kiln-dried beet pulp: 4 qts. molasses and 12 lb. of straw), the general health of the cow had not been maintained, and there was an average decrease in milk flow of 5 lb. per day.

The cows were then placed on fresh grass pasture for 3 weeks. The physical condition of 3 cows showed marked improvement but the others did not respond so quickly to the change in fodder. The production of milk did not increase materially. The milk was dried before using for feeding tests and Guinea pigs were then fed the equivalent of 80cc. per head daily in addition to oats and bran.

All the guinea pigs fed with dry fodder milk developed scurvy within 21 days and died within 56 days. On the other hand, animals which had received pasture milk lived for 120 days, and are still alive, two only showing mild signs of scurvy The contrast is striking and definitely illustrates the marked difference in antiscorbutic content of the 2 varieties of milk

A study of the analyses tables shows that the fat, protein and sugar percentages were very similar, but that there were certain well defined differences in the composition of ash of the 2 milks, the percentages of calcium and of phosphorous were significantly higher in the pasture milk and its citric acid content was over 50 % greater. There was however, less sulphur in this milk in spite of its somewhat higher protein content.

The authors consider that from this chemical examination, there is an evident danger of setting up rigid standards for milk constituents, and advocate the necessity of prefacing such results with full data as to the diet of the lactating animal

470 - **The Bacteriophagus Microbe. Immunity Agent in Plague.** — See *Review* April 1921, No 399

471 - **Annual Report of the Agricultural Experiment Station of the University of Wisconsin, 1918-1919.** — RUSSELL, H. L., and MORRISON, F. B., in *Bulletin* 319 *Agricultural Experiment Station, University of Wisconsin*, pp. 1-76, figs 29 Madison, Wisc., 1920.

Report of the experimental work conducted at the Station 1918-1919 ; brief resumés of publications issued by the station and financial statement for the year ending June 30, 1919.

Results of the more important experiments may be summarised as follows.

PRINCIPAL CROPS (pp. 3-26). — *Hemp*. — In the United States, Wisconsin occupies the leading position as regards the production of hemp, and in 1918-19 grew 4750 acres, *i. e* nearly one-third of the total acreage of the United States, and the quality of equally high value to the best quality hemp grown elsewhere.

According to the results obtained by A H. WRIGHT, hemp may be grown on various types of soil in divers localities, especially in the north

WRIGHT also conducted experiments with a view to improving the sorghum crop and methods for sorghum syrup manufacture. Experiments made in collaboration with farmers showed that varieties coming from the south-west of Wisconsin ripen very late owing to prevailing climatic condition.

NEW FACTORS IN THE PRODUCTION OF SILAGE (pp. 41-42). — E. G. HASTINGS (Agricultural Bacteriologist) indicates that the first organism which appears in considerable numbers in silage is one of the *coli* This produces a very considerable amount of carbon dioxide, small amounts of acids and from 0.6 to 0 7 % of alcohol.

The following experiment indicates that the formation of acid is due to the presence of bacteria : — Peas were grown in large test tubes, and after maximum growth had been attained were transferred to smaller containers which were immediately sealed. In these, none showed any signs of acid production

INHERITANCE OF MILK AND MEAT PRODUCTION IN CATTLE (pp. 53-54). — Crosses were made by L. J COLE between the two races Jersey cows and Angus bulls and results showed that the 1st generation cross-breds were all black polled like the Angus but in most other respect showed individual variation especially as regards milk production and meat production In the 2nd generation there was distinct variation in the matter of colour and horns. Some of the crossbreds, particularly the males possessed horney scurs, loosely attached to the skin.

BARLEY VERSUS OATS FOR WORK HORSES. (pp. 68-69). — As the result of an experiment with 10 teams of work horses made by MORRISON, BOHSTEDT and FULLER it may be concluded that crushed barley is about 10 % superior to crushed oats for horse feeding.

BARLEY VERSUS MAIZE FOR MILCH COWS. (p. 68). — Experiments conducted by MORRISON, HUMPHREY and HULCE.

Experiment I. — Two lots each of 6 cows were fed by the reversal method for 2 periods of 6 weeks each. When fed with a 60 % concentrate mixture (in addition to the ordinary roughage) of ground barley, the average daily yield of milk was 25.1 lb., and of butterfat 0.92 lb., and with others fed with ground maize instead of barley, the average daily milk yield was 25.6 lb., and of butterfat 0.94 lb, there was, however, a loss in weight with cows on the maize feed.

Experiment II. — Two lots each of 5 cows were fed by the reversal method for 3 periods of 5 weeks each When fed in addition to pasture with 5.6 lb., of a mixture consisting of 60 lb., maize, 30 lb., wheat bran, and 10 lb., cotton seed meal, the average daily yield of milk was 26.3 lb., and of butterfat 0.94 lb. When the same amount of ground barley was substituted for ground maize, the average daily yield of milk was 26.9 lb., and of butterfat 0.96 lb. The cows appeared to show a slight gain in weight on the maize ration and a loss on the barley ration.

FATTENING STEERS WITHOUT FEEDING MAIZE GRAIN. (pp 71-72) — Two lots each of 10 steers were fed by FULLER and MORRISON · Lot I fed on a an average daily ration, per head of: 12.5 lb shelled maize + 2.8 lb., cotton seed meal + 32.6 lb., maize silage, + 2.2 lb., mixed hay; Lot II on 3.6 lb., cottonseed meal + 56.6 lb., maize silage + 2.6 lb., mixed hay.

The gain in weight in both cases was more or less identical, Lot I showed, however, a better finish and shrank less in shipment and secured a somewhat higher price than those in Lot II.

BARLEY, SKIN MILK AND WHEY FOR PIGS (pp. 67-70-71). — Experiments conducted by MORRISON and BOHSTEDT: —

As a result of comparative tests with self-fed ground barley + tankage and self-fed shelled maize + tankage it was demonstrated that barley fed pigs required 15 % more grain but only about $^{3}/_{4}$ as much tankage as the maize fed pig

In the tests to ascertain the comparative value of skim milk and whey. made with pigs which averaged 137 lb., in weight, those fed on self-fed ground barley and tankage (given separately *ad libitum*) showed an average daily gain in weight per head of 1.64 lb., but the skim milk fed pigs gained 1.89 lb.

The tankage pigs required 450 lb., of barley and 23 lb, of tankage per 100 lb. gain. The skim milk pigs required only 406 lb., of barley and 340 lb, skim milk per 100 lb., gain.

MANUFACTURE OF CHEDDAR CHEESE AND CONDENSED MILK (pp.43-44). — With a view to regulating the flavour of cheddar cheese manufactured in the pasteurising process, experiments have been made by HASTINGS and SAMMIS by adding to pasteurised milk a lactic acid starter, and also a special starter made from digested milk which had been inoculated with material from certain natural foci of infection. Results gave cheeses with a marked improvement in flavour compared with control cheeses made from pasteurised milk by the regular process.

It has been demonstrated by SOMMER that the amount of acidity of fresh milk, has nothing to do with coagulation when the titration method is adopted, and the titration method employed in the condensories cannot therefore be regarded as a direct means of determining the suitability of milk for condensing It appears that milk with too much soluble lime will have a low coagulation point, but this can be corrected by the addition of either citrates or phosphates, which render the calcium less soluble.

CROPS AND CULTIVATION

472 – **Effect of Late Spring Frost upon Forest Vegetation in the Wasatch Mountains of Utah, U. S.** — KORSTIAN, C. F., in *Ecology*, Vol. II, No. 1, pp. 47-52, figs. 1, bibliogr. of 6 works Brooklyn, N. Y, Jan. 1921.

There was on exceptionally warm spell of weather in May 1920, and it was in fact the warmest May for 18 years. But at the end of the mouth (30th and 31st) the weather was unusually cold and considerable damage was caused to the native vegetation in the forests (all growth was on account of the season, about 3 weeks earlier than normal).

At the Cottonwood Nursery, located 25 miles south-east of Salt Lake City, at an elevation of 7400 ft., snow fell to a depth of 5 in , and during the night a minimum temperature of 15° F was reached.

A careful examination was made of all stock in the nursery, and of the native vegetation on the adjacent mountains; in order to obtain an idea as to the extent of damage caused by the frosts and the effect on each species individually

(1) *Picea Engelmanni.* — Trees 2 to 4 years old were seriously injured; the buds which had just opened had practically all the terminals, and many of the laterals of the current seasons growth killed. A few trees were killed entirely, others had a portion of last season's growth destroyed.

(2) *Picea Parryana.* — Approximately 10 % of the taller terminals were killed (a covering of snow protected the majority).

(3) *Pseudotsuga taxifolia.* — Seriously injured: stock rendered practically worthless.

(4) *Picea excelsa.* — Injured only to a slight extent.

(5) *Pinus ponderosa, P. contorta* and *P. monticola* — exceptionally resistant.

(6) *Abies lasiocarpa* and *A. concolor.* — Injured to a greater extent than the spruces.

In the nursery, it appears then that the *Abies* suffered most, followed by *Picea* and last by *Pinus*, evidently the most resistant.

In the forest, the greatest danger lay in the southern, south-western, south-eastern exposures as vegetative activity begins later; and for similar reasons the greatest amount of injury was observed at elevations of from 7000 to 8000 ft.

Acer Negundo, Alnus glutinosa, Sambucus sp., *Fraxinus excelsior, Acer campestre, Quercus* sp. (Gambel oak) were senously attacked by frost, and in many cases the previons seasons growth was killed.

Symphoricarpus oreophilus, Ceanothus velutinous, Ribes viscosissimum and *Prunus melanocarpa* were only partially frozen, and the damage was limited to current growth.

Naturally the well developed leaves fell to the ground, and the trees presented a winter aspect. At the end of June, however, a number of dormant buds on the growth of the previous year, which had not been killed off by frost, developed newly formed adventitious buds and new leaves.

The full vigour of the tree appeared to be concentrated into the relatively few stoots and new leaves, producing exceptionally large specimens ; in some cases measuring 8 ½ × 10 inches.

The contrast between normal and affected leaves was especially noticeable in the case of *Populus tremuloides*.

473 – **Irrigation Experiments with Sewage Water in Florida. U. S.** — Stalbner, F. E., in *Engineering News Record*, Vol. 85, No. 18, pp. 846-849, figs. 3. New York, Aug., 28, 1920.

The author gives a description of an irrigation system with sewage water, constructed by the Florida Agronomic Station in collaboration with the United States Department of Agriculture. It is constituted thus : — a septic reservoir — a layer of broken up stones forming a filter — an overflow — a condenser drain — a pump — 8 discharge plugs, acting automatically — a distribution canal system. According to when the lower plug is open or closed, the liquid which comes out of the filter passes directly over the field or rises to the upper part of the overflow and passes, across the lateral pipes, into the reservoir. The discharge into the lateral pipes is regulated by the automatic floating valves.

474 – **The Reversion of Superphosphate.** — Neumann, B., and Kleylein, K. (Mitteilungen aus dem Institut für chemische Technologie der Technischen Hochschule Breslau), in the *Zeitschrift für angewandte Chemie*, Year 34, No. 18, pp. 77-80, and No. 19, pp. 84-86, 16 Tables. Leipzig, March, 1921.

The reversion to an insoluble state of the phosphoric anhydride of water soluble superphosphates is a chemical process facilitated by 3 conditions:— (1) keeping the superphosphate for a long time in large heaps (especially if there is a deficiency of hydroscopic water and if the temperature is high); (2) the richness of the original phosphorites in aluminium compounds and, more especially, in iron, (3) in complete treatment with sulphuric acid in the lead chambers

The author summarise the previous work of Messrs. ERLENMEYER, OTTO, JOULIE, STOKLASA, SMETHAN, HERBST and SCHUCHT.

The objects of the authors' recent experiments were to determine to what extent, and in what manner, metallic sesquioxides effect the reversion of the phosphoric anhydride, and whether this could be prevented by any change in the method of manufacture.

Superphosphate contains tricalcium phosphate (which has escaped disintegration), monocalcium, and possibly even bicalium phosphates, but above all, free sulphuric acid, which acts in two different ways, both hindering and promoting retrogradation; in addition all these substances, as well as the iron and aluminium compounds, bring about reactions the products of which tend to react upon one another. For these reasons, the authors began by isolating the different substances that react when pure; they studied experimentally the phases of reaction, counter-reaction, and chemical equilibrium, and then gradually passed to the consideration of industrial superphosphate They carried out their laboratory experiments under industrial conditions as regards technique.

The conclusions arrived at by the authors were as follows

(1) If 2 molecules of sulphuric acid act upon 1 molecule of pure tricalcium phosphate, only 95 % of the phosphoric anhydride passes into stable monocalcium phosphate, on account of the counter-reaction., If the sulphuric acid is increased so that 3 or 4 molecules act upon 1 molecule of tricalcium phosphate, the yield of monocalcium phosphate is only 98 %, which agrees with the results of previous experiments by MILLOT The counter reaction is more or less promoted by the larger or smaller amount of calcium sulphate present, so that superphosphates obtained from calcareous phosphorites revert more easily.

(2) If the water-soluble phosphoric anhydride in pure monocalcium phosphate is estimated by the ordinary industrial method, in the presence of tricalcium phosphate, its solubility in water decreases with the increase of the tricalcium phosphate, and in proportion to the increase in the temperature. Therefore the more completely the sulphuric acid acts in the lead chambers, the lower is the keeping temperature of the heap of superphosphate, and the less intense the retrogradation process

(3) Increasing amounts of ferric sulphate, in the presence of a constant amount of pure monocalcium phosphate, cause the constant reversion of about 11 % of the soluble phosphoric anhydride, whereas increasing amounts of ferric oxide (between 1 and 16 %) give rise to the retrogradation of from 15 to 52 % respectively, in round numbers.

(4) Ferric sulphate has no action on the reversion of free phosphoric acid, the effect of small quantities (below 2 %) of ferric oxide (estimating the phosphoric acid as monocalcium phosphate, is imperceptible, where-

as the retrogradation continually increases with the amount of the oxide, and reaches 31 %, when the latter is present to the extent of 16 %. This is the reason why, if the phosphorites are rich in iron sesquioxide, and have not been sufficiently acted upon by the sulphuric acid, the monocalcium phosphate and the phosphoric acid present in the heaps of superphosphate largely revert, on account of the residual sesquioxide present.

(5) Aluminium sulphate has no effect upon the retrogradation of either monocalcium phosphate, or phosphoric acid. On the other hand, the presence of clay (in which substance the Florida phosphorites are rich), in amounts varying between 2 to 16 % of kaolin, causes a retrogradation of 14 to 49 % in the pure monocalcium phosphate, and but a slight reversion of the pure phosphoric acid.

(6) The complete disintegration of decreased bone powder (100 parts by weight of bone-ash and 74 of sulphuric acid at 55° Bé), gives an amount of water-soluble phosphoric anhydride which may be as much as 89.7 % of the total anhydride. If the acid is increased slightly, from 5 to 10 %, the amount rises to 97.4 % to fall again slowly, even if the acid be increased. Under these conditions, the amount of the phosphoric anhydride soluble in water and in citric acid remains nearly constant.

(7) The disintegration of prepared bone-ash in the presence of varying quantities of iron sesquioxide gives a superphosphate with a slight regradation (7 %) if the amount of the sesquioxide is 2 %. The process increases rapidly with the addition of the sesquioxide, and reaches 62 % if the latter is as much as 16 %. Under these conditions, the anhydride soluble in water and citric acid also greatly diminishes. Hence the fallacy of the very common idea that the reversion due to the presence of iron sesquioxide has no effect upon the manurial value of the phosphate, provided that the anhydride soluble in water and citric acid remains constant.

(8) Aluminium compounds have no effect in the disintegration of phosphorites.

(9) If during the disintegration of phosphorites with a high iron content, the amount of sulphuric acid is increased to over 90 % by weight of the mineral, the amount of water-soluble phosphoric anhydride in increased, but this does hinder the tendency to disintegration. On the contrary, this process can be modified in one way, namely, by previously mixing ferruginous phosphorites with phosphorites poor in iron, in such a way that the sesquioxide content of the mixture is below 2 % (1).

The authors add that the attempt to improve retrograded superphosphates or those which were badly disintegrated, by means of further sulphuric acid treatment, is quite useless as it only results in the superphosphates being covered with a deposit which makes them difficult to sell.

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(1) See *R.*, Sept. 1920, No. 845. (*Ed.*)

475 - The Presence of Copper in Plants, and Especially in Food Substances of Plant Origin (1). — Guérithault, B., in the *Comptes rendus de l'Académie des Sciences*, Vol. 171, No. 3, pp. 196-198. Paris, July 19, 1920.

The results of analyses made by the author, given in the appended table prove that copper is constantly present in food substances of plant origin, and no doubt also in all plants. In these experiments the amounts of copper found varied between 8-7 mgm, and 63.6 mgm per 10 gm. of ash, and between 1. 1. mgm, and 17.1 mgm, per kg. of fresh matter. Seeds were found to be particularly rich in this metal.

Copper content of Various Plants.

	Copper per kg. of substance			Copper per kg. of substance	
	dry	fresh		dry	fresh
	mg.	mg.		mg.	mg.
Sorrel (leaves).	27.5	2.4	Grapes	9.9	1.2
Spinach »	18.3	1.8	Oranges.	21.9	3.1
Lettuce »	36.3	2.0	Olives.	8.3	2.8
Carrots (roots).	17.6	2.2	Bananas.	8.7	2.2
Turnips »	29.7	3.0	Dates.	3.0	2.4
Radishes »	52.7	3.8	Chestnuts (fruits) . . .	5.1	3.2
Salsify »	22.6	3.2	Lentils (seeds)	—	6.6
Leeks »	22.7	2.5	Beans »	—	10.0
Beetroots »	24.5	3.2	Peas »	—	7.2
Cress (leaves and stalks) . .	18.1	1.5	Soy-beans »	—	9.0
Leeks (leaves).	54.3	5.0	Wheat »	—	7.2
Celery »	21.9	2.0	Rye »	—	7.5
Onion (bulb)	23.2	2.9	Barley »	—	6.5
Potatoes (tubers)	7 7	1.9	Oats »	—	17.1
Gherkins (fruit)	52.8	2.8	Maize »	—	6.8
Cucumbers »	50.0	2 3	Hulled rice	—	6.4
French beans	16.3	1.8	Cress (seeds).	—	11.3
Pumpkins (fruit)	10 9	1 1	Radish » . . .	—	6.0
Tomatos »	32.1	2.0	Walnuts (kernels)	—	11.2
Apples »	7.4	1.2	Hazelnuts »	—	12.0
Pears »	12.9	2.2	Sweet almonds. . . .	—	14.0
Cherries »	15.6	1.6	Bitter almonds . . .	—	13.0

475 - Composition of Tomato Fruits at Different Stages of Ripening. See No. 505 of the *Review*.

477 - Effect of Light Rays on *Azotobacter*. — Kayser, C., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXXII, No. 8, pp. 491-493 Paris, February, 21, 1921.

In a preceding article (2) the author studied the effect of different light rays on the 3rd and 6th generation of a culture of *Azotobacter*. He found considerable differences in the bacteria according to the conditions of lighting. In the present paper the author gives the results of the experiments he carried out with the view to determining the extent of the diminution of the assimilating power of the 12th generation, and discovered that this decrease was much affected by the colour of the light to which the cultures were subjected.

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(1) See *R.*, 1918, No. 619; *R.*, 1919, No. 619. (*Ed.*)

(2) See *R.*, March 1921, *No.* 269. (*Ed.*)

478 - **The Phytotechnical Station at Mahndorf, Germany; the Most Important Results Obtained and the Organisation of the Work' especially as regards the Registration of Observations.** — HANSEN, V., in the *Zeitschrift für Pflanzenzüchtung*, Vol. VII, Part, 4, pp. 283-318, 5 fig. Berlin, November, 1920.

The work of the Mahndorf Phytotechnical Station, and the selection experiments that have been made there, or are still in progress, are in many cases of the same character as the general selection work in progress in other parts of Germany and have been carried out on very similar lines. Nevertheless, this Station has certain characteristic features, a description of which may be of interest to agronomists

The experiment fields at Mahndorf are situated at an altitude of about 140 m. above sea-level, and occupy an area of 500 hectares. The soil is composed of the disintegration products of limestone rocks, and of various facies, but open soil mixed with pebbles constitute the commonest type.

The climate, which is somewhat inclement, is very well suited to the type of work undertaken at the Station, for the little snow that falls in winter, coupled with the cold winds that prevail at that season, test the resistance of the plants to low temperatures, while the frequent drought in spring and summer put their other hardy qualities to a severe proof.

So far, the following selected types have been placed on the marked :

Rye
" Dickkopf " winter wheat
" Bordeaux " spring wheat
" Hanna " barley
Oats
" Viktoria " early peas.

Obtained at Mahndorf

VARIETY OF RYE OBTAINED AT MAHNDORF. — This is the result of the selection of " Petkuser " carried out by Prof. REMYS in 1909.

Objects of the selection :— High yield of grain and straw ; high percentage of caryopses ; early ripening : resistance to cold and lodging. The ears should be of erect habit, compact and pointed, square in section, with 19-21 bi-floral spikelets. The presence of spikelets with three flowers is a sign of vigour, but is not desirable for it interferes with the even quality of the grain. The kernels should be greenish-grey, full, elongated, rather large, so that 1000 caryopses weigh from 45 to 55 gm., they should be well covered by the glumes. The average length of the culm is from 140 to 160 ; there are from 4 to 5 nodes ; tillering average ; the best plants have 6 to 10 culms.

This rye produces heavy crops, and is very resistant to cold. The ear, which was originally thin and rectangular, has become more compact through selection, and has assumed an oval, elongated shape The kinds with rectangular ears are also very early in ripening, the straw is short, the kernels are somewhat small, and of a greenish yellow colour On the other hand, the oval, compact ears ripen late, they grow vigorously and have long straw, resist cold well, and the kernels are always greenish-grey.

The best seeds from the different lines, which are separated by careful mechanical selection, are sown separately one by one. If the resulting plants have not the characters desired, they are eliminated, and the seleced types obtained in this way are excellent.

As rye is a staurogamous plant, individuals may appear among the descendants that are distinctly superior to the original stock. In order to be able to make use of these new forms, at all events to a certain extent, some of the finest ears are collected every year from the best lots. These ears are again tested, the finest are definitively selected, and the seeds thus obtained are sown separately, the seeds from each ear being planted in a row by themselves.

DICKKOPF WINTER WHEAT. — Obtained in 1900 from a field of "Mettes Squarehead" by individual selection (by ears).

Objects of selection :— Large grain yield and average straw yield; high grain percentage; resistance to cold, lodging, and rust. Ear ovoid, white, awnless, from 7.5 to 8 cm. long, and consisting of 25 to 28 spikelets. Kernels full and large, weight of 1000 kernels 40 to 45 gm., ; culms of average lengths, 100-130 cm., regular, and with 4 nodes; tillering average; 5 to 7 culms on the best plants.

The characters of this wheat have become fixed, and wild varieties are very rare. It is distinguished by its great resistance to cold, and its heavy yield.

Although *all* the Dickkopf wheat grown at Mahndorf has come from a single plant isolated in 1908, 3 types can, however, be distinguished. The early type has long ears, rectangular longitudinal section, low yield (relatively) and caryopses of average size. The late type is distinguished by the fine ovoid shape of its ears, short culms, and good yield. The 3rd type, now on the market, is of average earliness, the ear is slightly ovoid, the culm of average length, the kernels are large and the yield high.

In 1917, crosses were made between Mahndorf wheat and foreign varieties.

"BORDEAUX" SPRING WHEAT. — Obtained by selection from "Rimpaus Rote Schlanstedter Sommerweizen."

Aims of selection :— High grain yield and average straw production; high percentage of kernels, early ripening; resistance to lodging, rust (*Tilletia Tritici*) and smut (*Ustilago Tritici*). Ears 8 to 10 cm. long, dense, with 17 to 19 well-developed erect spikelets, smooth brownish-red glumes; culms equal, of average height with 3-4 nodes; tillering average, 5 to 6 culms per plant.

This wheat now includes the results of two selection. The products of the first are somewhat late, the ears are erect and almost entirely free from smut, and it is therefore eminently suited for large scale cultivation. On the other hand, the plants obtained from the other selection are earlier, their ears are slightly bent and are somewhat liable to the attack of smut, but their yield is very high, and, as so far no segregation of characters has been observed in them, they are worth further study. In 1919, the products of the two selections were crossed.

HANNA BARLEY has been obtained from the " Kwassitzer Hanna " variety.

Aims of selection :— High grain yield and average straw yield; high percentage of kernels earliness; resistance to lodging and smut. Ears 11 to 12 cm. long; compact, containing at least 30 kernels, which are large, somewhat rough, and weigh 60 to 67 gm. per 1000; culms of average length, 80 to 120 cm., with 5 nodes, without side-shoots; tillering average 8 culms per plant. This barley is an excellent variety for brewing, and as it is very hardy, is adapted to dry districts

Although all the selected plants were derived from a single individual that was isolated in 1907 nevertheless several different types are found among them · — (*a*) A late variety which bears the heaviest crops; (*b*) an early sort with fine large kernels, but liable to lodging; (*c*) a very early kind with small kernels, susceptible to *Ustilago,* but resistant to lodging; as it still shows segregation phenomena, it should be further studied.

MAHNDORF OATS. — Obtained by selection from " Strube-Schlanstedter Hafer. "

Aims of selection: — High grain yield and average straw yield; high percentage of grains; resistance to lodging; full, branched inflorerescence; grains yellowish-white, weighing 40 to 50 gm. per 1000. culm of average length, 120-150 cm., with 3-5 modes. The choice plants should have at least 3 culms.

As regards the number of grains per spikelet, 3 to 4 were formerly preferred, but now plants with bi-floral spikelets are chosen, for it has been found that this reduction in the number ensures better and more complete development of the grain.

Suitable crossings are also being carried out in order to improve the oats.

EARLY "VIKTORIA" PEA. — This has been obtained from a plant of " Strubes gelber Viktoria " which was isolated in 1901. The variety is noted for its early maturity; it ripens 10 days before the original variety but retains it characters of great productiveness.

Aims of selection :— High yield, early ripening, high percentage of seeds, (50-60 %) vigour. The flowering and ripening stages should be regular and short in order to obtain fruits that are similar in ripeness and development. The pods grow in pairs and should each contain 4 to 7 peas which must be very full, large, round, and yellow, with a diameter of 7 to 9 mm., and weigh 300 to 450 gm. per 1000.

The " Viktoria " pea has long been on the market and its characters are very fixed. There are several forms that are all equally stable, the most important being distinguished by the letters M, V, L, and showing the following characters :—

	Seed yield	Size of seeds	Length of flowering period	Ripening
M	good	very large	very long	late
V	average	large	short	average
L	good	small	very long	early

With the view to still further improving this product the forms M, V, and L. have been intercrossed. The following Table gives the results of the examination of the F_2 (harvest of 1919) :—

Analyses of the F_2 *of the different crosses.*

♀ < ♂	Seed yield per plant	Weight of 1000 peas in gm.	Flowering	
			Date of commencement	Duration in days
M × V	13.0	401	June 11	13
M × L	10.6	403	» 5	22
V × M	10.5	384	» 11	29
V × L	10.6	392	» 6	22
L × M	9.8	400	» 7	22
L × V	10.8	380	» 7	30
L × L.	11 1	380	» 6	25

In the cross M × V, the maternal characters are dominant

In the cross M × L, the yield is decreased, whereas the maternal character "large seed" is combined with the paternal characters of early flowering and duration of flowering. In the crosses V × M and V × L, the yield is average and the size of the seed average (maternal characters), whereas the date of flowering is that of the male parent. In the crosses L × M, L × V, and L × L, the maternal characters are dominant.

These forms are still being examined and sorted out with the object of isolating and fixing new types of good quality.

MAHNDORF LUCERNE. — This type is descended from an isolated and self-fertilised plant of Provence lucerne. It has not yet been put on the market. It is distinguished by the development of its leaves and its very soft stem ; flowers fine dark blue ; remarkable for resistance to cold and to rust (*Uromyces striatus* Schroet).

MAIZE. — A number of varieties of maize have also been selected with a veiw to obtaining early maturing varieties with a heavy yield.

POPPY. — In 1918, 2000 early ripening capsules of fine shape were gathered and a few of the best (9.5-6.3 gm, of seed per capsule) were chosen to supply seed for the experiments,

The seeds from each capsule were sown separately in a special row. The offspring differed in development, in length of stem, date of flowering, and the number of capsules per plant so that they provided all that was required for selection. The work was undertaken with the intention of obtaining a type with the following characters: — High yield per plant and per capsule; large percentage of seeds in proportion to the total weight of capsule; early maturity low, strong stalks; white flowers; 3-4 well developed, round capsules per plant; grey seeds.

PEDIGREE REGISTER. — This consists of 3 distinct parts, which are, however, bound together at the end of the year and form a single volume.

On the first page of the first part is given the plan of the experiment field, and the date of the sowing, as well as that of the germination of the seeds, etc. On the succeeding pages are entered observations upon the growth of the plants, and data respecting the harvest, reference being made to individual selection and to each line.

In the second part, are collected all the data referring to the offspring e g., observations made during development, the yield, and the average of the selection data for each plant The third part is the largest; it contains all the observations relating to the characters which are the object of the selection experiments, reference being made in each case to the plants chosen.

TABLE I — *Preliminary selection* (Vorauslese) (1) 1912-1913
Winter wheat.

(2) Group	Plants: Number of culms	Plants: Number of plants	Culms (total)	Distinguishing letter of the plant	Total length of the culms of 12 normally developed plants in cm.	Weight a) Not chosen b) Chosen (élites) c) Total: Grain and straw	Weight: Grain	a) Grain % b) Weight of 1000 grains	Observations
Co. 33	1	125	125	a)	1 701 cm.	a) 5 184	1 288	a) = 25.00	
	2	10	20	b)	1 682	b) 130	39	b) = 40.74	
	3	32	96	c)	1 696				
	4	46	184		5079 : 36 = 141.08	c) 5 314	1 327		
	5	55	275						
	6	45	270						
	7	26	182						
	8	25	200			21.72 gm. total weight			
	9	8	72		1 plant	5.42 » grains			
	10	1	10			16.30 » straw			
	—	373	1 434						

Harvest: 245 plants — Tillering $\frac{1434}{235} = 5.85$.

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(1) The first mass selection of the individual plants which is based on the correlation between one or more easily-determined morphological and physiological characters and the economic characters that are the object of the selection, is called the preliminary choice (*Vorauslese*). See FRUWIRTH, *Handbuch der landwirtschaftlichen Pflanzenzüchtung*, Vol. 1, p. 261.

(2) All the plants obtained by this mass selection are subdivided into groups, and the subsequent selection work is carried on within each group. See FRUWIRTH, *loc. cit.*, p. 244.

TABLE II. — *Selection* 1909-1910 *Winter wheat* (*individual selection*).

Weight of plant wit hout roots	Number of culms	Data relating to the straw							Data relating to the grain								Other observations
		Number of culms	Length in cm.		Number of internodes	Category (1)	Thickness of lowest node (mm.)	Other culm characters	Weight	Number of grains	Weight of 1000 grains	Percentage of grains	Number of spikelets				
			Culm (with-out ear)	Ear									Per ear	Empty	Half empty	on 10 cm. of culm	
27.15	4	1	84	8.0	4	1	5.2	1	—	—	—	—	21	—	—	—	
		2	82	7.4	4	1	4.7	1	—	—	—	—	20	1	—	—	
		3	90	7.7	4	1	4.6	1	—	—	—	—	18	—	—	—	
		4	85	7.8	4	1	4.7	1	—	—	—	—	19	—	—	—	
	Sum	—	341	30.9	16	4	19.2	—	—	—	—	—	—	—	—	—	
	Mean	—	85	7.7	4	1	4.8	—	10.65	215	49.5	39.2	78	1	276	25.2	

ıg culm moderately culm weak

TABLE III. — *Selection* 1919 *Winter wheat*

Plant No.	Weight of plant	Height	Culms					Ears		Spikelets			Grains				Percentage of grains
			Categories			Side Shoots	Total		In the 2 best ears								
			I	II	III			Type	Length of ear	Number of spikelets including empty ones	Empty	D	Weight 2×50 grains	Weight of 1000 grains	Weight	Quality	
1	42	107	3	3	2	—	8	K	8.6	25	1	3 0	27.28	55	16.5		39 %
									8.0	25	2						

TABLE IV. — *Observations on one line* (1) 1917 *of winter wheat.*

Plot No	Mark of the line	Quality of soil	Average total weight of plant		% seeds germinated	Development in spring	Number of plants at harvest	Cold resistance	Rust	Ripening	Yield in grains per plant				Grains			Ears									Culms				
																								Categories					Categories		
			a	b							5 élites	20 élites	Average weight for whole plot	Grain yield of 192 plants of plot	Weight of 1000 grains	Waste on sifting	% of grains	Type	Length	Number of spikelets	D	Number of empty spikelets on 3 ears	Weight of grains per ear	I	II	III	Length	Number per plant	I	II	III
10	C_0 3	4/1	20.8	23.6	85	1	83	100	1/2	3/4	12.6	12 7	10.8	1580	42/50	45	40	II	6.7	22	3.3	3	1.8	46	46	8	3/4	7.0	73	18	9

(1) The total progeny of an individual, or group of individuals

In order to give some idea of the method of registering the data, the following Tables dealing with the winter wheat, oats and peas have been appended: —

TABLE V. — *Selection of oats* 1920.

Plant No.	Culms			Total weight		Percentage of grains	Weight of grains per panicle	White spikelets	Grains		
	Length	Number		Of one plant	Of the grains				a × 50	Weight of 1000 grains	Quality
		Normal	Side-shoots								

(See Tables VI-X on pp. 536-537).

The new registration form is a great improvement on the one used before 1920. On the one hand, it excludes many quite useless entries, on the other, the data given bring out more clearly, the fundamental objects of the work of selection, and facilitate the isolation of the *élites* and best kinds of the plants selected.

479 - **Inheritance of Resistance to Bunt or Stinking Smut of Wheat, in the United States.** — GAINES, E. F., in *Journal of the American Society of Agronomy*, Vol. 12, No. 4, pp. 124-132, tables 8, Washington, D. C., April, 1920.

Investigations on the bunt resistance (*Tilletia Caries*) of 3 wheat varieties : Turkey (Washington No. 326.) Hybrid 128 (Washington No. 592) and Florence (Washington No. 634) and the 2 crosses Turkey × Hybrid 128 and Turkey × Florence.

Notwithstanding its distinct susceptibility to bunt, Hybrid 128 is very prolific, hardy, has a stiff straw and holds the grain well after maturity so that it is grown in large quantities. In 1918, about 2 000 000 bushels of Hybrid 128 were produced (graded commercially as White club), and 100 000 bus. of Turkey which is drought resistant, hardy, of high milling quality (graded as Hard red winter). The straw is, however, not very stiff and the grain scatters easily. It is produced in considerable quantities in the semi-arid districts of Washington.

Florence is a spring wheat of Australian origin (graded as common wheat) : very resistant to bunt.

In the summer of 1915, several hybrids were made between Turkey and Hybrid 128 and between Turkey and Florence. In 1918, the parents and hybrids of F_2 and F_3 were analysed in detail in order to ascertain the percentage of infected plants and of bunt on infected plants with a view to establishing a scale of resistance. The results are given in Table I: —

TABLE VI. — *Selection of peas* (1920).

Line	Length of culm	Weight of plant	% of seeds per pod	Number of seeds in 2 largest pods	Seeds					Weight of 100 seeds	% of seed	Quality of the seeds	Remarks
					Number								
					Good more than 7 mm.	Re-jected	Total	Good	R je				

E VII. *Observations on development and yield.*

Plot No.	Line	Series	Arrangement of the plants	Peculiarities	Maturit					Number of plants harvested		% of waste plants	ting f 7 mm.	Total weight of seeds			Average weight of seeds		Colour of the seed 1 = yellow 5 = green	% of plants with branched culms
					ring															
					begin-ning	end	length of time (days)	Maturity (fellow stage)	intermediate	ft	Total		% residue	of "élites"	of the remainder	Total	per plant ("élites" ex-cepted)	Average per plant in the plot		

TABLE VIII — *Observations on the development and yield of selected cereals* (1920).

Plot number	Stock	Plot	Line	Resistance to cold	Development in spring	*Ustilago*	*Helminthosporium*	*Puccinia*	Stalk			Ears	Maturity			Yielding grains	Size of grains
									Length	Fragility	Resistance to rains	Shape	Earing	Maturity yellow stage	Intermediate		
		I															
		II															
		III															
		IV															
		Average															

TABLE IX — *Observations on the development and yield of selected peas* (1920).

Plot number	Stock	Plot	Line	Peculiarities of habit	Maturity					Yield in grains	Weight of 100 grains	Quality of the grains
					Flowering			Maturity (yellow stage)	Intermediate			
					beginning	end	length of time (days)					
		I										
		II										
		III										
		IV										
		Average										

TABLE X. — *Selection of the poppies* (1919)

Plant Number	Length of stalk	Fruit		Grain		% of grains	Colour of the grain
		number	weight	weight per plant	weight per pod		

TABLE I.

Variety or hybrid	Infected plants	Bunted heads no infected plants	Total bunt produced
	%	%	%
Turkey	3.4	17.7	0.6
Hybrid 128	70.9	63.9	59.8
Florence	5.8	22.9	1.3
F_2 Turkey × Hybrid 128	76.4	47.9	51.0
F_2 Turkey × Florence	20.1	35.5	8.9
F_3 Turkey Hybrid 128	68.3	49.1	50.2
F_3 Turkey × Florence	22.1	45.5	15.4

Turkey × Hybrid 128 showed in F_2 a much high degree of infection than the susceptible parent. This may be attributed to the more vigorous growth of the hybrid which might cause more of the infected plants to survive the winter. On the other hand the percentage of bunt produced on the infected plants is much lower than that on Hybrid 128; the latter condition may be taken as an intermediate condition. The average of the F_3 bears out this supposition.

The F_2 of Turkey × Florence shows a much higher degree of infection than either parent. If resistance is caused by a series of chemical or physiological factors, then two facts are self evident:—

1) Most of the factors for resistance are recessive;

2) Turkey and Florence each have different and distinct factors for resistance.

The author carried out simultaneously a series of experiments with a view to ascertaining the correlation of bunt resistance and morphological characters of wheat plants. Comparisons were made between:

a) *length of spike*: — long bearded, club bearded and intermediate mixed.

b) *beards*: bearded — mixed — beardless.

In the F_3 of Hybrid 128 × Turkey, there appears to be no definite relation between the above mentioned characters and resistance. However, in the case of Turkey × Florence, there is an inverse correlation between bunt resistance and the bearded characteristic.

Very resistant rows existed, however, and numerous gradations between these extremes were found in each morphological type examined, which indicated that existing correlations do not suffice to constitute a solid base for selection of more resistant types.

The F_3 of Turkey × Hybrid 128 produced a continuous series from 1 row as resistant as Turkey to 77 which were more susceptible than Hybrid 128.

The small number of highly-resistant rows indicated a dominance of susceptibility of Hybrid 128. Out of 194 not one of the F_3 rows shewed more resistance than Turkey. There is evidently no single or latent heritable factor for resistance in Hybrid 128. On the other hand, there must be at least 3 independent factors for resistance in Turkey, otherwise there would have been a larger number of rows as resistant as Turkey.

TABLE II. — F_3 of *Turkey* < *Florence.*

Spike characteristics	No. of rows	Plants bunt free	Plants bunt infected	Plants party bunt			Total No. of plants
				Number	Healthy	Infected	
Bearded	38	387	74	90	823	585	**551**
Mixed	78	795	86	112	1017	892	**993**
Beardless	52	421	39	55	442	425	**515**
Total . . .	**168**	**1603**	**199**	**257**	**2282**	**1902**	**2059**

The results obtained seem to warrant the following conclusions: —

(1) Bunt resistance in wheat is not a simple Mendelian unit character.

(2) Resistance, if Mendelian, is composed of multiple factors, for a continuous series ranging from complete immunity to complete susceptibility has been obtained.

(3) Different wheat varieties possess different kinds of resistance.

(4) Linkage between resistance and morphological characteristics is not sufficient to prevent the selection of a resistant strain of any morphological type desired.

480 - **Studies on the Factors and Circumstances Determining the Success or Failure of Crosses Between Wheat and Rye.** — FIRBAS, H., in the *Zeitschrift für Pflanzenzüchtung*. Vol. VII Part 4, pp. 249-252. Berlin, November, 1920.

Results of the study of the biological and environmental factors which petermine the success or failure of experiments in crossing wheat and rye.

1st YEAR. — Hybridisation experiments in which Bokhara wheat was fertilised with the pollen, or mixtures of the pollen, of certain varieties of rye. Bokhara wheat has all the characters of a "population" consisting of various strains having in common the characters of early maturity and rust resistance but differing in some morphological points. Thus, there are awned and awnless forms; the latter, however, are not constant but produce occasionally both awned and awnless plants.

The wheat ears were fertilised with fresh pollen at different times commencing from the date of the flowering stage (when all the glumes, or most of them, have fallen from the ear) until 5 days subsequent to that phase.

Contrary to what had previously been stated, the best results were obtained by fertilising the plants at the time of flowering; a delay of 5 days produces entirely negative results.

In addition to Bokhara wheat the following wheats were used in the crossing experiments. Igel, awned Loosdorfer, Molds Squarehead, red awned Galician (Roter Galizischer Grannenweizen), Czar, Weisser Epp,

TABLE I. — *Results of 1st years' cross.*

State of the maturation of the ear	No of flowers fertilised	No of grains formed	No of seeds germinating	No of hybrids obtained
At the time of flowering	94	30	25	25
One day after » »	98	19	16	16
Two days » » »	90	5	5	—
Three » » »	89	4	4	3
Four » »	81	16	6	6
Five » » »	94	3	2	—

and March spelt. Out of the several hundreds of flowers pollinated, only 2 hybrids were obtained, and were from Roter Galizischer × Rye. Thus the degree of sexual affinity between rye and wheat varies considerably in the case of different varieties of wheat.

2nd. YEAR. — A series of experiments was made with a view to determining the effect of environment, especially of heat, upon the phenomena in question. Comparative experiments were carried out in the open, and under shelter, viz. in greenhouses (at the temperature of the surrounding air or heated), in parchment bags, isolated cylinders etc. None of these environments had any effect upon the crossing results nor were the latter influenced by the age of the pollen.

3rd YEAR. — The first years' experiments showed that the different varieties of wheat varied in their degree of affinity to rye, Bokhara wheat showing the greatest amount. Very great differences were, however, found to exist in this respect between individuals of the same variety.

In the experiments carried out for the purpose of studying this phenomenon, Bokhara wheat was chiefly used ; 12 plants were selected and gave the results set forth in Table II.

TABLE II. — *Results of the Third Year's Crosses.*

Caracters of Wheat plant	No of flowers pollinated	No of grains formed	Varieties of rye supplying the pollen
1) semi-awned	71	5	Askanier, Hanna
2) awned	108	5	Askanier, Hanna
3) awnless	128	17	Hanna, Sperling
4) »	151	10	Petkuser, Tulaer
5) »	65	60	Petkuser, Tulaer
6) »	93	7	Seelhorst
7) »	104	4	Seelhorst, Tulaer
8) »	94	1	Sperling
9) semi-awned	122	3	Tulaer, Petkuser, Sperling
10) awnless	90	1	Zeeländer
11) »	77	1	Zeeländer
12) semi-awned	119	—	Loosdorter

Thus, the individuality of the female parent has a distinct effect upon the results of the crossing; this is especially seen in the case of Bokhara wheat. In that of other varieties, it is much less apparent, as is shown in crosses made with Czar, Red Saxon wheat (Rot Sächsischer Landweizen) and Mold's Squarehead.

481 - **A Brachytic Variation in Maize and its Agricultural Value for Dry Land Cultivation in the United States.** — KEMPTON, J. H., in *United States Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 925, pp. 1-28, pl. XIX, figs. 7, tables, 5, bibliogr. of 14 works. Washington, Febr., 18, 1921.

ORIGIN OF THE VARIATION. — Variations are many in the maize but the brachytic variation deserves special attention, since it possesses several highly desirable features advantageous for dry-land and irrigated conditions.

This variation consists of a shortening of the internodes without a corresponding reduction in their number or in the number and size of other organs. The distinction between this type of variation and ordinary dwarfing is evident. The brachytic strain of maize under consideration arose in a hybrid between the Algerian pop-corn and the Chinese waxy varieties. (No. Dh 416). F_2 was the result of self-pollinating, an F_1 plant being grown for seed characters. Of the plants obtained, 5 were brachytic and 21 normal (1). One of the brachytic plants was self-pollinated and the resulting progeny were all brachytic; at the present time 16 progenies are under observation. Those derived from self pollination gave in F_1 plants as tall as or taller than the normal parent, while F_2 showed a segregation into normal and brachytic plants closely approximating the Mendelian 3 to 1 ratio.

For the Table giving the measurements of maize plants of two sister progenies, one of which was brachytic and the other normal in stature, see prevous article (1).

There are apparently two types of internodes; 1) almost triangular and 2) obliquely truncated cylinder.

Brachytic characteristics have also been obtained by crossing Chinese Waxy and Boone County White (Kansas). F_1, F_2 and F_3 appeared normal; in F_4, however, 2 brachytic plants were found. One of these was self-pollinated, and its progeny offered a striking contrast to those derived from the Chinese-Algerian hybrid. Only 10 plants were grown from this self-pollinated ear, and 9 of them were of normal stature, the other being brachytic. A brachytic plant appeared also in a progeny of the Esperanza variety of *Zea hirta*, this was crossed with a normal plant of the Chinese waxy variety and the hybrid has been designated Mh 17 by COLLINS; neither F_1 nor the following generations showed any evidence of brachysm.

AGRICULTURAL ADVANTAGES. — Brachysm in maize produces a form of plant which seems admirabily adapted to meet the unusual requirements of dry land and irrigated regions, and in addition to this shows resistance to lodging thanks to its sturdy erectness.

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(1) See *R.*, Oct. 1920, N. 958. (*Ed.*)

With the exception of the Navajo or Hopi type of maize the roots which appear at germination serve only to establish the young seedling; subsequent growth and development depend upon the roots produced from nodes.

In most varieties of maize grown under common cultural methods, from 4 to 8 nodes remain in contact with the ground and produce roots. The uppermost node which produces roots is usually somewhat above the surface of the soil; the young roots are covered with a sticky, transparent gelatinous substance which affords protection from the dry atmosphere and permits them to reach the soil from a height of about 10 cm. (Boone County White variety).

In brachytic plants, the reduction in the length of the internodes results in more nodes coming in contact with the ground, thereby increasing the production of roots, (as much as 40 % over the common varieties). In addition to this increase may be added a further increase of about 15 %, due to the increase in the diameter of the culm.

In irrigated regions the taller varieties of maize lodge badly following irrigation, especially if there is a moderate wind. The brachytic plants are thoroughly anchored and owing to the increased root system, are able to withstand such conditions and remain erect.

Also the reduction in internode length brings the leaves close together, thus effecting a partial shade at the time when the sun is at its height; transpiration is thus reduced and should result in a lower water requirement for brachytic plants.

As a general rule, the commercial varieties of maize are taller than is necessary to satisfy the physiological requirements for yield of grain. The increased height is due almost entirely to the elongation of the internodes and not to an increase in the number of nodes. The brachytic variation affords a means of reducing the stature, with no corresponding reduction in leaf area. There should be no physiological difficulties in combining high productivity with brachytic stature.

Genetically, however, more difficulties are to be expected. Yield of grain, like most quantitative characters is one of those relatively unstable characters difficult to recover from hybrids involving small-eared varieties. If only 10 factors are involved in maximum grain production, all of these would be expected to occur in homozygous combination with brachytic culms in an F_2 hybrid only once in 4 195 304 plants. It is difficult to obtain a combination of good production and brachysm, but it is, however, not unlikely that by crossing a combination of dwarf stature with high productivity of commercial varieties, the value of the strain would be appreciated in area outside the regions of extreme climatic conditions.

INHERITANCE OF BRACHYSM IN HYBRIDS WITH COMMERCIAL VARIETIES. — *Brachytique* × *Boone*. Effort to combine the brachytic character of the culm with the high productivity of commercial varieties. Two crosses were made with the Boone Country White var., and a few of the F_1 plants were self-pollinated; 3 ears resulted and 3 F_2 progenies were obtained. The F_2 plants grown in the field were fully as large as the Boone parent and remarkably uniform.

The F_2 progenies segregated into normal and brachytic plants, 3 : 1 monohybrid ratio , (234 normal and 74 brachytic). The normal plants of the F_2 exceeded the brachytic plants not only in stature, but also in the length of the longest leaf, in the number of rows on the upper ear, and in the length of the ear stalk The brachytic plants, on the other hand, exceeded the plants of normal stature in the number of branches in the tassel, the diameter of the culm, the total number of leaves, and the number of nodes that produce roots.

In yield, as measured by the total ear length, neither the normal nor the brachytic F_2 plants equalled the F_1, but individual plants were obtained which gave a yield equally high, as the best of the F_1 With a sharp segregation into normal and brachytic plants, the procedure to be followed in securing the desired combination of brachytic stature with high yield becomes greatly simplified and eventual success becomes more certain. It is necessary only to cross the best yielding of the segregate brachytic plants with the high yielding commercial varieties and repeat this procedure until the desired combination is obtained.

Brachytic × *Hopi* — The Hopi variety, in common with other varieties, grown by the Indians of the South western States, possesses the long mesocotyl which permits deep planting. An attempt was made to combine the brachytic stature with the deep-planting adaptation. The F_1, was a complete surprise ; the plants were tall but liable to lodging, the ears were small and the yield poor. The F_2 was much better.

Economically therefore, the combination of brachytic with Hopi has been a complete failure and demonstrates the impracticability of predicing the value of a hybrid from the characteristics of the parents.

482 - **Heritable Characters of Maize ; Adherence of Leaves, Bracts and Inflorescences.** — KEMPTON, F. H. (Bureau of Plant Industry, U. S. Department of Agriculture) in *The Journal of Heredity*, Vol. XI, No. 7, pp. 317-322, figs. 4. Washington, D. C., Sept-Oct. 1920.

Adherence is a variation in which the leaves, bracts and inflorescences coalesce. This may occur to a varying extent, and in extreme cases the upper leaves and terminal inflorescences are so firmly compacted into a hardened mass that the parts can not be separated. Frequently the leaves and even husks adhere so firmly to the other organs, that they are ruptured by the force of the elongating plant. and such plants have a characteristic ragged appearance.

Adherent variation was found in the F_2 of a hybrid between Boone County White and the brachytic variety.

Plants combining the brachytic and adherent variations were difficult to propagate, and although the data obtained are few, it seems, not unreasonable to suppose that adherence is a simple Mendelian character recessive to the normal condition

483 - **Behaviour of Hybrids of F_1 *Medicago sativa* × *M. falcata*, in the United States.** — WALDRON., L. R., in *Journal of the American Society of Agronomy.* Vol. 12, Pt. 4, pp. 133-143, figs. 4. Washington, D. C., April, 1920.

Report of determinations made relative to the weight of plants and length of stems of F_1 hybrids secured from crossing *Medicago sativa* × *M. falcata*.

WEIGHT OF PLANTS. — The following table gives the distribution of frequencies of weight in grams of the two alfalfa plants and their reciprocal hybrids.

Group	101–200 gm	201–300 gm.	301–400 gm.	401–500 gm	501–600 gm.	601–700 gm.	701–800 gm.	801–900 gm.	901–1000 gm.	1001–1100 gm.	1101 1200 gm.	1201–1300 gm.	1301–1400 gm.	1401–1500 gm.	1501 1600 gm.	1601–1700 gm.	1701–1800 gm.	Total
M. sativa . .	2	6	24	42	68	68	50	36	17	5	3	1	—	—	—	—	—	322
M. sativa × *M. falcata* .	—	1	1	6	5	5	19	17	15	11	20	8	4	4	4	1	1	122
M. falcata . .	3	28	50	71	57	50	29	28	9	2	1	—	—	—	—	—	—	328
M falcata × *M. sativa*. .	—	6	13	17	24	32	41	23	25	27	16	6	2	3	1	—	—	232

The most outstanding facts about these distributions are: 1) The greater amount of variation among the hybrids than among the parents. 2) The weight of the hybrid is significantly greater than those of the parents *e. g.* — *M. sativa* = 636.8; *M. sativa* × *M. falcata* = 964 4, *M. falcata* = 543.4; *M. falcata* × *M. sativa* = 776 3:

LENGTH OF STEMS. — Significant differences between parent and hybrid are not shown, *e.g.* *M. sativa* = 85.5. *M. sativa* × *M. falcata* = 87.0, *M. falcata* = 80.7, *M. falcata* × *M. sativa* = 87.2.

RESISTANCE TO WINTER INJURY. — The percentage of plants destroyed by winter injury was as follows: *M. sativa* = 7.72, *M. sativa* × *M. falcata* = 6.55, *M. falcata* = 1.04 , *M. falcata* × *sativa* = 3.30.

The resistance of the parent *falcata* is evident from these data. The hybrid behaves as an intermediate in each case, but quite differently in the two reciprocal crosses; the best results are obtained when *M. falcata* is the maternal parent

484 - **A Vetch Plant with Lentil-Shaped Seeds in Czeco-Slovakia.** — FRUWIRTH, E , in *Zeitschrift fur Pflanzenzuchtung*, Vol VII, Part 4, pp 356-362, 1 fig. Berlin, November 1920

In the Botanic Garden of Chlumetz, in the winter 1919-1920, a plant was observed growing in a bed of lentils (*Ervum Lens*), which in appearance and habit entirely resembled a vetch (*Vicia sativa*), with the exception, that its seeds were flat and similar in structure to those of the lentil.

A like occurrence had already been noted by Prof. LEGANY at Magyaróvár, by SCHREYVOGL at Loosdorf, and by WIEGMANN.

The author carefully studied the progeny of the Chlumetz plant to the second generation. It was at first supposed to be a natural hybrid of *Vicia sativa* and *Ervum Lens*, but the following facts are at variance with this theory:

1) These hybrids could not be obtained artificially; 2) the Chlumetz plant, which should have been a hybrid of the F_1, except for the aberrant shape of the seed, was in every respect a vetch; 3) in the 2nd generation, there were no segregation phenomena, the shape remained absolutely constant, and the plant transmitted its unaltered characters to its descendants.

Since the probability of its being a spontaneous variation is also excluded, the author concludes, that the Chlumetz plant and its progeny form a pure line of vetch.

Hitherto, cultivated vetches have not been systematically selected, and form populations composed of a mixture of forms; amongst the latter, plants bearing more or less flat seeds are by no means rare. By the selection of extreme cases, it would be easy to isolate types of vetch with seeds shaped like those of the lentil.

485 – **Experiments in Self-Pollinating and Cross-Pollinating *Hevea brasiliensis* in the Dutch Indies.** — HEUSSER, C., in the *Mededeelingen van het algemeen Proefstation der A. V. R. O. S.*, year V, No. 1, pp. 1-6. Medan, January, 1920.

The improvement of *Hevea* in chiefly based upon the vegetative propagation of trees selected as likely to supply the best scions.

Nevertheless, the question has arisen of late as to the possibility of obtaining good results in this direction by means of crossing and selection.

There are two ways in which this work may be carried out: — 1) By using the best individuals, of the filial generation for subsequent crossing, with the object of fixing (by means of transmission through succeeding generations) the best types, that is to say, those possessing the best combination of characters; 2) by obtaining grafts of superior quality from the selected hybrids.

The present report contains the results of many experiments in self-pollinating and cross-pollinating.

CROSS-POLLINATION. — Twenty suitably-chosen trees were used for this purpose, 30 different crosses, being made. Out of a total of 6710 operations, 730 (10.8 %) gave positive results, 2186 seeds being obtained.

The highest percentage of fruit set was in the cross ♀ 138 × ♂ 146, with 83 fruits resulting from 211 pollinations (39.4 %). The crosses ♀ 164 × ♂ 144: ♀ 29 × ♂ 141; ♀ 139 × ♂ 146, and ♀ 139 × ♂ 26 gave entirely negative results

In the course of the experiments, it was observed that the fertility of the female parent is a very variable character, and further, that the number of fruits formed on the same tree differ according to the nature of the tree from which the pollen is taken.

Thus, when the female parent 157 was crossed with Nos. 161, 166, 164 and 161, the percentages of fruits set were respectively, 2. 4, 7, 14.7 and 8.1

SELF-POLLINATION. — This was effected on 6 trees. In the case of 4 out of the number, the results was entirely negative ; the 5th produced but one fruit, although as many as 170 flowers were pollinated ; as for tree 164, out of 131 pollinations, only 9 were successful.

This is a confirmation of the fact that *Hevea* is normally staurogamous, and that self-fertility can only be induced if the greatest precautions are taken.

The following Table gives the data of the experiments.

		Pollinations						
	Date	No of flowers	No of branches	No of fruits set	Percentage of fruits set	No of seeds obtained	No of germinating seed	Female parent Average daily yield in 1919
142	10 Feb. and 12 Mar.	220	45	—	—	—	—	107 cc of latex
164	22 March .	131	18	9	6.9 %	30	28	141 » » »
36	9 May . . .	135	84	—	—	—	—	80 gm rubber
49	25 May	232	98	—	—	—	—	33 » »
138	15 May	306	50	—	—	—	—	41 » »
174	12 April	170	40	1	0.59 %	3	3	38 » »
	Totals . . .	1 194	335	10	0.8 %	33	31	

The fruits of tree 164 furnished 30 seeds, of which 28 germinated regularly. The development of the seedlings was most carefully watched, to see if there were among them types giving a large yield, and at the same time endowed with great self-fertility, which would much simplify the work of selection as regards line 164.

486 - **The "Herald", New Variety of Prune in America Originating Probably from *Prunus Munsoniana* by Mutation.** — DETJEN, L. R., in *The Journal of Heredity*, Vol. XI, Pt. 6, pp. 253-258, figs. 5. Washington, D. C., July-Aug., 1920.

The tree described is growing in the garden of W. F. MARSHALL in Raleigh N. C., and had been purchased from the Stark Bros. Nursery Louisiana (Mississipi) under the name of "Milton plum," as belonging to the *Prunus Munsoniana* Wight and Hedrick species.

The following are the special characteristics associated with the "Herald" compared with "Milton"

1) The stem is attached to both branch and fruit which prevents the latter from dropping to the ground as soon as ripe, and instead they dry naturally in the sunshine and wind ;

2) The leaves are somewhat small ;

3) The petals are rather larger (the corolla measures on the average 17 mm) ; compared with 13 mm. (Milton).

4) The pit is larger in dimensions than that of the Milton ;

5) Milton variety grafted on *Prunus angustifolia* took well and grew vigorously, whilst " Herald " proved less vigorous, and died off early

It is of interest to note the effect a different stock, *Prunus angustifolia* exerts on the Herald variety; the fruits and pits diminish in size, and the surface of the fruit is velvety like that of *P. angustifolia*, unlike the hard characteristic of the Herald fruit.

The author believes that the existence of the Herald variety may be attributed to mutation arising from the native *Prunus Munsoniana* This mutation as already noted possesses the advantage of producing fruits which dry and shrivel as readily as the European types, but cannot be expected to compete with any of those owing to the soft and juicy texture. However, it should be possible eventually to obtain by crossing with the best commercial varieties, a new type combining the characteristics of the fruit of *P domestica* with resistant and late flowering qualities, which could be utilised with success in eastern America, where the climatic conditions and fungoid diseases at present hinder the growing of commercial varieties.

487 - **New Society for the Production of Selected Seeds in Zagabria (Yugo-Slavia).** — *Zeitschrift für Planzenzuchtung*, Vol. VII, Pt. 4, pp 367, Berlin. Nov., 1920.

On January 1, 1920, a Society was founded in Zagabria which proposes to encourage the production of selected seed throughout the Serbian, Croatian and Slovac Empire. This Society possesses an experimental field where various kinds of crops are cultivated and selected. The propagation of the types and varieties thus obtained is put into the hands of Members of the Society.

Prof. V. MANDEKIČ has been nominated as consulting expert of this Society.

488 - **Studies on Sorghum Seed ir Wisconsin. U. S.** — See No. 471 of this *Review*.

489 - **Wheat-Growing Experiments in the Province of Turin, Italy.** — BOCHICCHIO, in the *Italia vinicola ed Agraria*, Vol. XI, No. 10, pp. 159-150. Casale Monferrato, March, 6, 1921.

Experiments carried out on the estate of the Royal Agricultural College of Caluso (Ivrea region, Province of Turin), in 1920.

The following varieties of wheat were sown broad-cast on fairly compact soil in the second half of November and manured with superphosphates The appended Table gives the resuts obtained.

Varieties	Yield of grain in Kg. per hectare
1) Red Canavesano Wheat	973
2) Hybrid Gentil rosso × Noé	1164
3) Carlotta Strampelli	1250

On another area where the soil was light, the wheat was sown with drills an December 3 and manured with superphosphate, with the following results:—

Varieties	Yield of grain in kg. per hectare
1) Semi-awned Gentil rosso wheat	944
2) Hybrid Gentil rosso × Noé	940
3) Early Piedmont Wheat	970

Carlotta Strampelli may be said to have stood the test well, seeing that the season was bad, and the ripening of the wheat had been much hindered by scorching.

The author does not share the opinion of wheat growers who consider this variety to be subject to lodging and dissociation of characters, but he considers that it is necessary to grow earlier varieties in Piedmont amongst which " Early Piedmonte " (obtained by Prof. JACOMETTI by crossing) in worth mentioning. The hybrid Gentil rosso x Noé obtained by PASSERINI is very adapted to late sowing; semi-awned Gentil rosso did not give satisfactory results. Canavesano wheat never gives very high yields, but it is especially suited to damp, compact soils.

490 - **Field Experiments with Maize in New South Wales 1919-20.** — CLAYTON, E. S. in *The Agricultural Gazette of New South Wales.* Vol. XXXVI, Pt. 1, pp. 1-6. Sydney, Jan., 1921.

Report of experiments conducted at the Grafton Experiment Farm 1919-20 on black alluvial soil.

I. — HILLING VERSUS FLAT CULTIVATION. — The plot hilled with the disc cultivator presented a cleaner appearance and damaged fewer roots than in the case when hilled with the plough. None of the plants showed any tendency to lodge and the main benefit derived from the hilling was the burying of the weeds in the rows. The following shows the comparative yields per acre according to the different treatments: — hilled with disc cultivator 48 bus. 41 lb; flat cultivator, 44 bus. 42 lb; hilled with plough 42 bus. 19 lb.

II. — " DE-SUCKERING " *i. e.* REMOVAL OF SUCKERS. — The experiment was carried out on two plots, each ½ acre in area. It was estimated from the results that 1 ton of greenstuff per acre was obtained by the de-suckering. As however the untreated plot yielded 70 bus. 34 lb. and the treated plot 69 bus. 55 lb. the loss of maize amounted to 35 lb.

III. — DEEP VERSUS SHALLOW CULTIVATION. — The plot receiving deep cultivation (5 in. deep) presented the cleanest appearance throughout but the roots of the maize plants certainly seemed to be damaged, especially toward the later stages of growth during the process. This was clear from the yield per acre (39 bus. 10 lb.). The plot receiving deep cultivation (5 in.) till the plants were about 15 in. high and than shallow cultivation (2 to 3 in.) until tasselling, gave very simular results (43 bus. 16 lb. per acre) to that obtained with shallow cultivation throughout (42 bus. 48 lb.). The crop sown in November 19, was harvested the following August 20.

IV. — GREEN MANURING EXPERIMENT. — Grey field peas, rape, and vetches were the green manure crops tried, sown at the rates of 12 lb., 1 ½ lb. and 10 lb. per acre respectively. The land had previously been occupi ed by a wheat crop. The following results were obtained:—

	Yield per acre	
	bus.	lb.
Maize with rape sown at tasselling stage	69	52
» » grey field peas	68	11
» » vetches	63	25
» » alone	66	30

V. — LATE CULTIVATION. — An experiment carried out with the idea of comparing the yield of maize cultivated up to tasselling time with that of maize receiving only one cultivation after hilling. The preparation of the land and the details of sowing were identical with those of the suckering experiments. The first mentioned method gave the more satisfactory results, 68 bus. 36 lb. per acre compared with 63. bus. 16 lb.

VI. — RATE OF SEEDING. — Two varieties of maize were used: — Leaming and Improved Yellow Dent. The former was sown at varying distances apart at the rate per acre of 6.5 lb. 8.1 lb. 9.3 lb., and 13 lb. and the latter at 8 lb., 10 lb., 11 ½ lb., and 16 lb. per acre.

In both experiments, the lowest rate of seeding gave the lowest yield. In the Yellow Dent var. the highest net gain per acre was obtained from the heaviest seeding, namely 16 lb. of seed per acre. In the Leaming var. the highest net gain was obtained from the second heaviest seeding, namely 9.3 lb. per acre.

491 - **Employment of Agricultural Machinery in the Cultivation of Rice in California.** — APOSTOL, S. (Chief Plant Industry Division Philippine Bureau of Agriculture), in *Bulletin Agricole de l'Institut scientifique de Saigon.* Year III, No 1, pp 1-3. Saigon Jan., 1921, and *The Tropical Agriculturist,* Vol. LVI, No. 2, pp. 86-87. Peradenya, Ceylon, Feb, 1921.

The author has recently completed an extensive tour of most of the principal rice growing countries of the world, and has chosen this subject in view of the tendency in many such countries to adopt modern methods of cultivation. He keeps in view throughout the special climatic conditions of California, and confines himself to a simple exposition of the actual methods observed by him during his visit, leaving the reader to make his own deductions as to their practicability under other and different conditions.

Up to the present time the cultivation of rice in California has been confined to the broad valley of the Sacramento, which is exceptionally favourable to the employement of modern agricultural machinery. In practice this is often of considerable power and weight. Multiple ploughs, often with 8 or 10 shares are employed for working the land. On one occasion a specially heavy single-shared plough, drawn by a pair of 75HP tractors was seen in action breaking up the bunds before the general working of the land commenced.

Harrowing and reconstruction of the bunds are also carried out by mechanical methods. Transplanting is not practised; in its place large seed drills are employed. Weeding is the only occupation carried out by hand, and for this the labourers. —. many of them Asiatic — receive a daily wage of from 3 to 4 ½ dollars.

Threshing is done in the field, when all the sheaves within a radius of about half a mile are carried in specially constructed waggons, to the threshing machine, and when all these have been threshed, the machine is moved further on.

The grain is often transported in sacks of " burlap " or " gunnies " direct from the field by means of motor lorries or in trains of trailers drawn by tractors. The 4 wheel drive tractor is especially esteemed for this class of work.

The exceptionally favourable topography permits the establishment of large square fields of 5 to 15 acres — often of 30 acres or more — thus facilitating the employment of large machines. Apart from this, and the many other local considerations especially favourable to the use of machinery, the extremely low rainfall (21.3 inches per year) is very significant. The author gives a table showing the average rainfall per month and per year covering a period of 10 to 46 years ending in 1916 for the Sub-Stations of Biggs, Chico, Colusa, Durham, Gridley, Marysville and Willow, in the Sacramento Valley. The monthly average is 45.2 mm. and the yearly average 542.8 mm. The rainfall is heaviest in December and January.

The land is worked immediately after the harvest in October, and the beginning of November. The frosts and thaws of the winter months make subsequent harrowing easy. The final working of the land is completed in March and April. The first day of April is considered as the commencement of the sowing season which continues up till the beginning of June, although it is estimated that the best results are obtained when the seed is sown not later than May 10.

The fact that all the cultural operations can be carried out during months when the rainfall is slight (average of 42-2 mm. November, February to May), together with the admirable irrigation and drainage systems which allow the soil water to be controlled, will account for the ease and efficacy with which agricultural machinery is employed.

492 – **The Influence of Size and Character of Seed on the Yield of Potatoes.** — SALAMAN, R. N., in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 1, pp. 43-48, tables 4. London, April, 1921.

In 1920, a preliminary investigation of the above problem was begun. For this purpose a stock of a new variety (1) was employed which had been grown in Barley, Herts, the previous year; the tubers had been clamped during the winter and sprouted in the spring.

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(1) This potato is not, as yet, on the market. (*Author's note*).

This main crop variety was well adapted to this type of experiment for two reasons: it is an exceptionally heavy cropper and it is extremely resistant to leaf roll and mosaic disease. The tubers are white kidney and are immune to wart disease.

Selections of the seed tuber were made by the author according to various grades, and the number of tubers in every found weight of seed was carefully checked. The tubers were selected both for size and weight so that each class was as uniform as possible. The classes selected were — 1) 0.4 oz., 2) 1.3 oz.; 3) 2 oz.; 4) 2.6 oz.; 5) 4 oz.; 6) 5.3 oz.; 7) 5.6 oz.; 8) 6 oz; 9) mixed seed of all sizes

The results of the experiments so far as this first year allows of conclusions, are: —

1) That although small chats give a big return in proportion to their weight as seed, and produce as much, in this experiment even more, big ware than any class of seed, yet it is certainly not economical.

2) The best seed class are tubers of 2 oz. in weight and these give the best returns, excepting the large tuber sets with secondary growths.

3) Seed tubers over 2 oz. in weight give smaller crops whilst the amount of seed is progressively greater. The amount of heavy ware is progressively less, both actually and relatively.

4) The tendency to secondary growth formation is not conveyed to the crop from the seed tuber. It is a peculiarity of big tubers and is not directly influenced by the size of the seed tuber. That the sets with secondary growth should have proved such successful seed is, however, not surprising as they naturally indicate a high vegetative activity on the part of the parent tuber, which experience has long shown to be the best type of tuber seed. Seed tubers with secondary growth make exceedingly good seed, and apart from the fact that they are large and wasteful without cutting, the evidence would tend to show that their use as seed is strongly indicated.

As the value of a potato crop is concentrated in the main on the quantity of the large ware size tubers formed, it is of interest to refer to the table where the percentage of the entire crop represented by the tuber of 4 oz. and over is shown. The highest value, 73 % of the total crop is given by seed tubers of less than 1 oz. in weight. *i. e.* by chats., so that it would appear that the larger the set, the smaller the quantity of big ware. When, however, the fact is taken into account of the bigger crop from the 2 oz. sets, the total yield per acre of large ware is considerally greater in this than in any other class. It, however, cut tubers with secondary growth will yield in the same manner as the large ones of class 8, then the advantage of such sets might at least equal that of the 2 oz. set in the production of heavy ware

The crop of a potato plant must be expressed in the quantity of tuber material produced, and its subdivision into tubers depends on other factors and is probably influenced by environment. The general approximation of the numbers of tubers in the classes of the crop from mixed seed, with that of the average of the 8 seed classes, is a fact of considerable interest (See tables).

493 - **The Production of Alfalfa Seed in New South Wales.** — WHITTET, J. N., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt. 2., pp. 105-112, pl. 16. Sydney, Feb. 1921.

Within recent years the cultivation of alfalfa has spread to the drier parts of New South Wales, and good results have been obtained from Bathurst, Coolah, Canowindra, Binnaway, Coonabarabran, and Pallamallawa districts, with both crops and also seed.

The method recommended for planting in the drier parts of the State is to sow the seed in drills 30 to 36 in., apart, in order to maintain a friable surface soil by hocing between the rows.

The varieties tested at the different experiment farms in these dry districts were selected from the best local strains and also introduced varieties; amongst these were included: Tamworth Broad Leaf, China (from the Pekin plains), Cossack, Semipalatinsk, Kansas, Montana, and Grimm (from U. S. A.) Variety Grimm had given excellent results in the United States as the most superior alfalfa in respect to winter hardiness. Montana is also extremely resistant to frost, and appears to suit the cold regions of New South Wales better than var. Grimm.

In the most satisfactory alfalfa growing districts the general rate of sowing is 15 lb. per acre but as much as 20 lb. is occasionally used, with a view to obtaining a fine stemmed for hay. Germination tests in the Department's Laboratory extending over a number of years show an average of 80 %, but this does not include the hard seeds. If the seed coats of the latter are scratched before planting, the majority of them will germinate successfully. Good results have been obtained by lightly rubbing the seed on a rough surface, such as that of an ordinary fine brick. Tests are still in progress to obtain data as to the length of time the untreated seeds, which failed to germinate after 14 days under cover, will take to germinate after being allowed to dry and then sown in soil. The following results are interesting from the point of view of rapidity of germination: — which is an important consideration from the farmer's point of view.

Percentage of germination total in 7 days.

	Sample		
	1	2	3
Hard seed not scratched	16 %	20 %	4 %
» » scratched	96	70	84

A fairly high standard of purity has been maintained by alfalfa growers and importers according to the particulars obtained from the seed testing laboratory records here reported. A list of the common weed seeds is given, and instructive identity photographs are given of the seeds: — *Centaurea melitensis, Plantago lanceolata, Carduus lanceolatus, Chenopodium album, Setaria viridis, Paspalum dilatatum. Cynodon Dactylon. Melilotus parviflora, Cuscuta Trifolii, Polygonum aviculare, Rumex Acetosella, Carex paniculata, Rumex crispus*, Shrivelled alfalfa seed, hard alfalfa seed, and normal alfalfa seed.

C. Dactylon, P. dilatatum and *P. distichum* are three of the very worst pests in an alfalfa field as they not only crowd the alfalfa plants but cause considerable trouble to the mowing machine.

The December cutting is generally reserved for seed purposes, and should be harvested when the majority of pods are yellow. When harvesting small areas, the crop should be cut with a scythe, and if a mower is used, a swath-board should be attached. If a reaper and binder is employed, the sheaves should be piled into shocks and stand for 5 to 10 days and allowed to become throughly dry before stacking and threshing, or properly adjusted so as not to bind the crop, but merely drop it into heaps by means of the sheaf carrier.

Stacking should be made in a manner similar to that for alfalfa hay, building it with a good foundation of straw. Small quantities are threshed with a flail, but alfalfa seed threshers are also available.

Four to 8 bus. per acre of seed are obtained in a favourable season on good quality alfalfa land, on medium class land, 2 to 3 bus.

494 - **Factors that Affect Alfalfa Seed Yields.** — BLINN, P. K., in *Colorado Agricultural Experiment Station Bulletin* No. 257, pp. 1-32, figs. 27. Fort Collins, Col., 1920 (résumé in *Experiment Station Record*, Vol. 44, No. 3, p. 230. Washington, 1921).

Experiments made in cooperation with the Office of Forage Crop Investigations of the U. S. Department of Agriculture, concerning seed setting tendencies of the different strains and the effect of seed selection on improvements of seed yields; moisture requirements, irrigation, cultural and spacing tests; observations on the relations of insects, climatic conditions, and soil fertility on alfalfa seed production.

The conclusions may be summarised as follows:— A difference in the inherent seed-setting tendency of different strains of alfalfa was noticeable, the southern strains, particularly from Ecuador, Peru, and Tripoli appearing to be strongest in this respect. These are not considered adapted to the climatic conditions, lacking hardiness. Although seed selection for prolific seed yield improved the ability of the selected stocks to produce seed yields, the improvement is not thought sufficient to solve the problem.

The amount of moisture for alfalfa seed production should be so regulated that a minimum amount of forage growth will result and still have sufficient moisture to mature the seed. Making a pasture of the first growth late in the spring has apparently stimulated good seed yields, and this seems to be coupled with a system of irrigation such as to regulate the amount of water and hold it close to the minimum requirement by having small irrigation furrows about every 30 in,

A thin uniform stand, about 1 plant to 1 or 2 sq. ft. is advised to ensure good seed yields. Growing alfalfa in rows is not recommended chiefly on account of the difficulty in handling the crop,

But very little evidence that bees are essential to alfalfa seed yields is at hand. Dry climatic conditions with high temperatures seem to be among the most essential requirements for successful production. It appears that excessive quantities of soil nitrates possess deleterious effects on seed yields in many irrigated regions reserved for alfalfa.

495 - **The Use of *Saccharum biflorum* as a Forage Plant in Algeria.**— GUIGNARD. Paper presented at the Meeting of the Academie d'Agriculture, held on March 23, 1921., in the *Comptes Rendus des Seances de l'Académie d'Agriculture de France*, Year 1921, Vol. VII, No. 12, pp. 308-311. Paris, March, 1921.

Dr. TRABUT communicates the results of experiments made on the coast of Oran, with the object of fixing the sand dunes by planting *Saccharum biflorum* (1). The experiments carried out in the dunes of Bon Hacheria, and on the Gay estate at Khemis, were eminently successful. *Sacc biflorum* proving to be useful not only as a wind-break and a fixer of moving sands, but also as an excellent forage plant.

According to information received from the chief Inspector of the Waters and Forests, the first cuttings were planted at the end of 1919, 50 cm. apart and in lines at intervals of 5-10 m. in rectangles prepared in the dunes of Bon Hacheria. These plantations are now 1 m. wide, and the plants have attained the height of 4 metres, forming a dense growth. Wherever the sands have collected near the lines, the width of the plantations has still further increased; owing to the contact of the stems with the soil, adventitious roots have been formed at each node, thus forming new growing points. It has been found that other Gramineae which have been used with success elsewhere (varieties of *Ricinus*, Takaout (*Tamarix articulata*), and other varieties of *Tamarix*) are here only auxiliaries that can well be dispensed with, as their effect is of little account as compared with that of *Saccharum*.

With regard to the use of *Saccharum biflorum* as a forage plant GAY, the Colonial correspondent of the Botanical service, sends the results of the following experiments carried out at his farm on the coast:—

Cuttings 30-40 cm. long were set 50 cm. apart; the plants soon spread over the intervening spaces, and formed an unusually luxuriant meadow. *Saccharum* shoots again immediately after cutting, and is able to furnish several crops a year. It should be planted in the spring, but cuttings take root at any season Animals had been found to eat the plant with avidity, therefore it was used on a large scale as a stock feed during the recent period of scarcity. It sufficed to keep 36 horses and mules, and 42 oxen in perfect condition, so that they never missed one day's work. The foliage was ted in its natural condition, and the stems were cut up and chopped with a vine-cane breaker.

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(1) See *R.*, Feb. 1921, No. 158. (*Ed.*)

The composition of the plant is as follows:—

	Per cent.
Water	74.8
Albuminoids	2.4
Fats	0.45
Nitrogen free extracts	13.4
Crude fibre	0.48
Ash	2.45

From what has been said, *Saccharum* might be planted with advantage on the sands of French regions bordering on the Mediterranean, but it is in West Morocco that it would render most service.

496 - **Yield and Quality of Hemp in Wisconsin, U. S.** —See No. 471 of this *Review*.

497 - **Indian Jute (*Corchorus* spp.).** — Mc Leod Sir Chas., in *The Asiatic Review*, Vol. XVII, No. 50, pp. 302-306. London, April, 1921.

Jute in India, can be grown in almost any soil which has a good depth and the necessary material required for fertilisation. On the alluvial soils in Eastern Bengal, jute grows freely without any artificial help. On the other hand the higher lands are heavily manured and yield heavy crops, not only on this account, but also owing to the fact that the jute has better chance of ripening on land immune from floods. Early in February, the ploughing commences on low-lying lands, and continues until the beginning of May on the higher lands.

After the land is ploughed and pulverised the seed is sown broadcast, in quantities of from 6 to 12 lb., per acre. The two principal species cultivated are *Corchorus capsularis*, and *C. olitorius*. The former is easily distinguished by its round pods, while the latter has long cylindrical pods, which are more easily decorticated than *C. capsularis*, and this is a distinct advantage although the last mentioned can stand submersion better, and generally speaking is less easily affected by adverse climatic conditions. Notwithstanding these peculiarities, it has been proved beyond all doubt that each of these species would yield a different class of fibre if subjected to different conditions of soil and climatic influences.

The period of harvesting varies according to the district, and starts earlier in the lowlands than elsewhere. Early cut jute is however never very satisfactory; it is usually immature, short and mossy. The process of "retting" usually takes anything from 10 to 35 days according to the time of year. In July and August, when the temperature of the water is high, the process is quicker, and the jute is ready for further handling, but in September and later, it takes quite a month to "ret" the plants. After retting is completed, the plants are taken out of the water, the fibre extraced, washed, and dried, and when sufficiently dry, it is rolled up in drums, and sent to the nearest market or sold locally to small dealers, who take it away to some of the large centres and dispose of it at a considerable profit.

The use of jute presses in the jute districts has greatly facilitated transport. These are used to pack what are known as "cutcha" bales, containing 3 to 3 ½ maunds*. The exported bale to Europe and other countries is of a fixed standard of 5 maunds or 400 lb. The packing is chiefly done in Calcutta.

Normally, jute is the cheapest fibre for providing bags to carry the produce of nearly the whole world. It carries all the valuable wool and grain from the various countries where grain and oil seeds are produced. Other uses are also enumerated by the author including several uses locally in the jute districts of India, and also its utilisation for the making of sand bags during the war.

498 - **Plants Suggested for the Manufacture of Paper in Various Countries** (1). — I. South African Grasses for Paper Making, *Bulletin of the Imperial Institute*, Vol. XVI, No. 2, pp. 127-134, London. 1918. — II. Tropical Grasses as Paper Making Materials (Fed. Malay States of Australia). *Ibid.* Vol. XVI, No. 3, pp. 271-275, 1918. — III. Investigations of Materials suggested for the Manufacture of Paper (South Africa, Rhodesia, Egypt, Papua)., *Ibid.*, Vol. XVII, No. 2, pp. 141-159, 1919. — IV. Further Investigations (Egypt, South Africa, New Zealand, Brazil), *Ibid*, Vol. XVIII, No. 3, pp. 232-335, 1920. — V. Paper from Bagasse in Formosa, *Queensland Agricultural Journal*, Vol. XV, Pt. 2, p. 67. Brisbane, Feb., 1921. — VI. Les végétaux susceptibles de fournir une bonne pâte à papier en Madagascar, *Le Bois*, Year 4, No. 11, pp. 1. Paris, Mar., 17, 1921. — VII. Un myrobalan à papier (*Terminalia Arjuna*), *L'Agronomie coloniale, Bulletin mensuel du Jardin Colonial*, Nouv. Sér, Yr. 5, 1920-21, No. 34, pp. 111-112. Paris, Oct. 1920. — VIII. PACK, A. N., Pulpwood from British Columbia, in *American Forestry*, Vol. 26, No. 324, pp. 715-719. Washington, D. C., Dec. 1920. — IX. Paper from Veneer Waste in U. S. *Ibid.* p. 762. Dec., 1920. — X. PEARSON, R. S., The Manufacture of Paper Pulp from Bamboos in India, in *The Indian Forester*, Vol. XLVI, Nos. 11 and 12, pp. 547-565 and 603-631, pl. 3. Allahabad, Nov. and Dec., 1920. — XI. Utilisation of Bamboos for Paper Making in Various Countries (India, Ceylon, Indo-China, China, Japan, Philippines, Malaysia, Dutch E. Indies, Australia, America, Brazil, W. Indies, Africa, Madagascar), *Bulletin of the Imperial Institute*, Vol. XVIII, No. 3, pp. 403-427. London, 1920.

I-III-IV. — SOUTH AFRICA (2). It has long been realised that the tropical countries possess in their coarse grasses, abundant raw material for the manufacture of paper. A number of grasses have been sent to the Imperial Institute from South Africa for trial, and a selection of the reports is here given: —

a) *Sorghum halepense* (3). — This grass gives a good yield of pulp, but is nevertheless not very promising as a paper making material. The pulp contains a large amount of parenchyma derived from the pith, which renders the paper parchment-like. This might however lend a possibility for the production of special kinds of parchment like papers either by itself or mixed with other fibrous materials.

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* 1 maund = 82.28 lb.

(1) See also *R.*, April 1921, No. 436. *(Ed.)*

(2) See *R.*, Aug. 1918, No. 869.

(3) See *R.*, Feb. 1920, No. 202. *Ed.)*

b) *Andropogon* spp. — 1) A sample of "thatching grass" or "Dek Gras," identified as *Andropogon Buchanii.* Stapf, received in 1917. In every case the pulps furnished an opaque paper of good strength and quality, which did not shrink appreciably on drying, and appears a promising material for the manufacture of strong brown paper, or after bleaching, for other purposes. — 2) *A. Dregeanus*, Nees, and *A. auctus* Stapf "Tambookie Grasses." Both samples gave good yields of unbleached pulp, which produced tough, strong papers of good quality. — 3) *A. hirtiflorus* var. *semiberbis* Stapf — This grass give s a good yield of pulp but the ultimate fibres are short and the paper produced is somewhat inferior is strength to that yielded by the aforementioned species. It would however be quite suitable for the manufacture of paper pulp on a commercial scale.

c) *Trachypogon polymorphus, Cymbopogon Ruprechti* and *Cymbopogon* sp.(1). — These grasses give very good yields of pulp which compare favourably with the yields obtained from esparto grass (*Macrochloa tenacissima*) under similar conditions. *T polymorphus* is found in tropical and sub-tropical America, and Madagascar, and in South Africa is known as "steek" grass.

d) *Themeda Forskalii* var. *mollissima.* — Yields a pulp giving a strong opaque paper which does not shrink appreciably on drying. The nodes of the grass are however harder than those of "tambookie" and "dek" grass, and would necessitate a through boiling and beating in order to break them up completely and obviate the presence of yellowish specks in the paper.

e) *Tristachya Rehmanni.* — Common in the Transvaal High Veld. — The shortness of the ultimate fibres rendered an inferiority in strength to the opaque paper obtained. It might however be utilised locally in admixture with better materials, such as *Andropogon* spp.

f) *Panicum obscurans.* — Common on the High Veld. On account of the presence of small bracts, and their effect on the paper produced, this grass is decidedly inferior as a paper making material to most others from South Africa put to the test, and would probably only be suitable for the manufacture of cardboard or brown paper.

g) *Aloe dichotoma* "Kokerboom," — Found in Namaqualand. One of the largest of the South African aloes, reaching a height of 15-25 ft. or more with a trunk 2.3 ft., in diameter at the base. On removing the bark and leaving to dry in the air, it was found that 100 parts of the original stem yielded 21.4 parts of air-dried decorticated material. The ultimate fibres were of good length (2 to 4.4 mm.), but were rather coarse and harsh. Results on the whole show that kokerboom is not a promising paper making material. The pulps produced give a fairly strong opaque brown paper which however could not be bleached.

III. — RHODESIA. — *Ricinodendron Rautanenii*, "Mungongo." — Results of examination of the wood samples received showed that this wood is not a promising material for the manufacture of paper pulp by the soda process but it is possible that pulp, of a somewhat better quality might be obtained by the sulphite process.

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(1) See *R.*, Nov. 1916, No. 1162.

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"Mugugubova Bark." It is improbable that this bark could be remuneratively exported but might be utilised locally for paper manufacture.

IV. — BRAZIL. — The Aninga plant (*Monthrichardia arborescens*) occurs abundantly in parts of Brazil, and considerable attention has been paid in recent years to the possibility of extracting the fibre for use as cordage material and utilising the stems as a source of paper pulp. Results show that the stems would yield a pulp furnishing a good brown paper, but cannot be bleached sufficiently for writing or printing purpose.

III. IV. — EGYPT. — a) *Cyperus alopecuroides*. — The stems give a fair yield of moderate quality. By fairly drastic treatment (*e. g.* 20 % caustic soda) a pulp yielding a fairly white paper of moderate strength can be produced, and the removal of parenchyma by washing would probaby improve the quality although decreasing the pulp yield; suitable for native use. b) *C. Papyrus* Moderate yield of pulp of fair quality; pulp suitable for brown paper can be prepared from stems by mild treatment. Inferior to *C. alopecuroides*, but suitable for use locally. Mature specimens are richer in cellulose and give a higher yield of pulp than young stems.

c) *Typa* sp. (Burdie Grass). — Moderate quality pulp, but suitable for production of brown wrapping paper or cardboard: did not bleach well: — suitable for local use only.

II-III-IV — AUSTRALIA (1) NEW ZEALAND, PAPUA, NORTHERN TERRITORY, FIJI. — a) Bamboo grass (2) from the N. Territory gives a good yield of pulp about equal to that obtained from Algerian esparto grass. After submitting to adequate processes, the grass may be considered suitable for the manufacture of pulp or paper (brown or white) either for local use or for export.

b) *Podocarpus spicatus* (Matai or Black Pine). — Not very satisfactory: — wide spread distribution in N. Zealand.

c) *Hibiscus tiliaceus* Linn. — Young stems consisting of fibrous bark enclosing soft wood, give a good pulp yield but of somewhat inferior quality in Fiji and suitable for local use only.

d) *Imperata arundinacea* Cyr. (3) (Lalang Grass). The sample received from Papua showed that this grass compares favourably with Algerian esparto grass, and is worth about the same price. For the manufacture of white paper, a slightly more drastic treatment than the latter is required, but unbleached pulp of good quality suitable for the production of strong wrapping paper and cardboard can however be prepared, and the grass used to advantage in Australia.

V. — *I. arundinacea* is also reported from the Federated Malay States, Ceylon and North Queensland.

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(1) See *R.*, Feb. 1917, No. 149.

(2) Botanical identity to be ascertained by the Imperial Institute London.

(3) See *R.*, Feb. 1917, No. 149. (*Ed.*)

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VI. — **Formosa.** — A successful paper making industry has been established, employing bagasse (1) (dry refuse of sugar cane after the juice has been expressed) as the raw material. Well made bagasse paper possesses several valuable qualities, it is far more durable and more waterproof than papers made from other materials. These are natural qualities and point to the conclusion that when advantageously employed it may be used for purposes beyond wrapping and printing

VI-VII. — **Madagascar.** — The following specimens are notified as giving advantageous results: —

a) *Ravenala madagascariensis*, common on territory lying between the forest area and the sea coast; 45 % utilisable cellulose, b) *Cyperus aequalis* "zozoro" and *C latifolius.* — Common in the marshes and peat districts · gives a good quality pulp: 22-23 % utilisable cellulose: c) *Phragmites communis,* "bararata, common in swampy districts in the west: d) *Hyphaene coriacea* "satrama" and *Borassus flabellifer* "dimaka" common in the savannah e) *Trema grisea* "andrarezina · f) *Dombeya* spp. "Lafatravonono" and "Lafotrofotsy" g) *Cusonia* sp. "vantoilana". h) *Terminalia Arjuna* Bedd., specimens were introduced into Madagascar in 1900 by Em. **Prudhomme**, then Director of Agriculture in this Colony. The plants came from the Indies and Ceylon.

The fruit of these trees has recently been sent to the Jardin Colonial, Nogent-sur-Marne and investigations have been made to ascertain the possible utilisation of the same for tanning hides. However, the percentage of tannin content was found to be very low (2.80 to 3.61 %), and **Lavergne**, assistant in the research department of the Jardin Colonial, considered it advantageous to test the possibilities in connection with paper manufacture.

According to the results obtained in the laboratory it was found that the yield of dry cellulose undiluted., after baking for 8 hours, under pressure of 6 kg. (155-160°C) was 29 %. This cellulose is fine, long and gives an excellent greyish pink paper without blemish and very strong The fruits of *T. Arjuna* should therefore serve a distinctly useful purpose as a first quality material for the manufacture of paper, provided that large quantities could be obtained at a cheap rate.

i) *T. polymorphus* (See S Africa).

VIII. — **British Columbia.** — According to the reports published in 1918 by the Commission of Conservation of Canada, the total amount of timber in the coast region of British Columbia of species suitable for the manufacture of pulp is over 92 billion ft. or approximately 132 million cords. (1 cord = 600 board ft.) Nearly two thirds of this is western hemlock (*Tsuga heterophylla*). A wood which seems to possess the necessary qualities of fibre which permit its use largely in place of spruce for the manufacture of newspaper pulp; of the rest, 58 % is Sitka spruce (*Picea sitchensis*) and 42 % balsam (*Abies grandis* and *A. amabilis*). The country is just awakening to the value of western hemlock. The growth of the pulp and paper industry in Brit. Columbia was very rapid in the last two years.

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(1) See *R.*, July-Aug. 1920, No 799 (*Ed.*)

IX. — UNITED STATES. — In the wood waste from veneer factories in the United States Forest Products Laboratory a considerable variety of raw materials were found suitable for the manufacture of high grades of paper. Among the veneer woods with paper making possibilities are: red gum (*Liquidambar styraciflua* L.); yellow poplar (*Liriodendron tulipifera* L.), cotton wood (*Populus deltoidea* Marsh); birch (*Betula lenta* L.); tupelo (*Nyssa aquatica* Marsh.); basswood (*Tilia americana* L.); beech (*Fagus americana*, Sweet).

Other economic factors being favourable, a mill could profitably operate on a daily supply of veneer waste equivalent to 50 cords of ordinary pulpwood.

IV-X-XI. — UTILISATION OF BAMBOOS (1). — The high price of wood pulp has caused paper manufactures to search for new materials which could be used as a source for paper pulp, and the most promising of these is bamboo. These yield a pecto-ligno-cellulose, intermediate in character between the cellulose of esparto and that of coniferous wood: when crushed and boiled it can be converted into an excellent, easily bleachable pulp. The 4 chemical processes which have been applied to the production of bamboo pulp are described in detail (*viz.* the sulphite, soda, sulphate, and lime, processes.). Art. XI gives a brief survey of the general distribution of species throughout the world : 320 species belong to the monsoon region of Asia (15 out of the 30 genera + 136 spp. in India) 179 species (belonging to 8 genera) (*Chusquea* and *Arundinaria*) in S. America; 49 in Japan; about 30 in the Philippines; 8 in New Guinea; 3 in Queensland; 4 in New Caledonia; 2 in the Pacific Islands; about 24 in Africa; 5 in Madagascar; and none in Europe, though a considerable number have been planted for ornamental purposes.

Particulars are given especially from the point of view of their utilisation for paper making, and of the present position and prospects of the industry in certain countries :—

X. — *India*. — A considerable amount of progress has been made in perfecting processes of manufacture during the last few years, and also in searching for further suitable areas from which bamboos can be extracted, and a possible factory site at sufficiently low rates to make it a profitable concern. The idea of manufacturing paper pulp from the raw materials available from the forests of India, dates back nearly 60 years, though it is only lately that schemes have materialised to utilise the bamboos in factories. PEARSONS' object in his article is briefly to review pre-and post war conditions, and to bring the available information up to date.

The interest now manifested in starting this industry coincides with the period of flowering of the more common species of bamboo such as: *Melocanna bambusoides*, *Cephalostachyum pergracile*, *Bambusa polymorpha*, *Dendrocalamus longispathus*, and *Bambusa Tulda*.

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(1) See *R.*, Oct.-Dec. 1919, No. 1144. (*Ed.*)

The importance of this point cannot be over estimated when it is taken into consideration that these species will probably not flower again for from 30 to 40 years. As conditions now stand, in areas where bamboos have recently flowered, the amount of raw material will be least, and the cost of extraction greatest during the first years of working whilst the yield will tend to increase and the price of extraction to fall with every successive year.

Considerable advance has been made in the process of preparing bamboo pulp. The author quotes the latest treatments in India, and also in Scotland. It was not until 1912 that it was discovered that by crushing bamboos between heavy rollers, and then chopping them into small pieces, both nodes and internodes could be utilised together.

Under the present conditions, the author does not definitely state what the ultimate cost of producing 1 ton of air-dried pulp would be, but taking into consideration the improvements in manufacture as against the higher cost of labour, chemicals, coal, etc., it is thought that bamboo soda pulp can still be produced well within Rs. 125 per ton.

After a general survey of the various bamboo areas both in Burma and India, the most favourable position for a factory site is considered to be at Badarpur in the Kata-khal Catchment area, as all the main rivers by which the bamboo forests are drained, converge on that point, and here also the Assam-Bengal Railway crosses the Borak river.

The possible out-turn depends on 3 factors namely: 1) The area of the forests from which bamboos can be exploited: 2) the density of the crop; 3) the estimate based on the figures obtained by taking sample plots; 4) the rotation of cutting. The most suitable Indian bamboos from the point of view of abundance and availability are: *Bambusa polymorpha*, (" kyathung "), *Cephalostachyum pergracile* (" tinwa ") *Bambusa arundinacea* (" dongi ") and *Melocanna bambusoides* (" muli "), all of which have been found to give high yields of pulp.

The average yield per acre is 23.5 tons. The area of forests from which bamboos can be exploited is 164 000 acres, and the sustained annual yield will therefore work out to 570 585 tons. This is a far greater yield than could possibly be required by any one paper mill, and hence the opportunities for opening up further factories.

Attention is drawn to the fact that both bamboo and Sabai or bhabar grass (*Ischaemum angustifolium*) are found in some cases in the same locality and as the latter has up till now been found to give a better quality paper pulp than any bamboo, this fact should not be overlooked in the choice of a factory site. Bamboo pulp is equal to if not better than imported sulphite spruce. *I. angustifolium* is obtained from the hill forests of the Hoshangabad, Chlindwara, Butul and Narsinghpur Divisions.

In the first mentioned Division, a pulp mill for this grass and bamboo is under contemplation. The respective value of the proposed sites elsewhere is discussed. Taking everything into account probably no country in the world seems to have more extensive natural and accessible areas occucupied by the larger and more valuable bamboos than Lower Burma. The area of bamboo forests has been stated to be over 24 000 000 acres with a possible output of at least 1 $^{3}/_{4}$ million tons of dry stems per annum. The next largest areas occur in Bombay, Madras, Assam, Mysore and the native State of Cochin.

Ceylon. — Bamboos occur in the southern lowlands and at a height of 4000 to 5000 ft. on the mountains in the interior. The small *Ochlandra stridula*, and *Bambusa arundinacea*, *B. vulgaris* and *B. nana* are cultivated and much used in building, but these could probably all be used as paper material. In the mountain region, slender shrubby species of *Oxytenanthera* (*O. Thwaitesii*) and *Teinostachyum* (*T. attenuatum*) and 5 spp. of *Arundinaria* occur.

Indo-China (1). — It has been estimated that there are 50 to 90 species of bamboo indigenous to French Indo-China, including several of those shown to be suitable for paper pulp in Burma.

China. — At least 60 kinds appear to occur in the country, including, *Phyllostachys heteroclada* "chung-chu," abundant in Central and Western China; *Bambusa arundinacea* "tzŭ-chu;" *Dendrocalamus giganteus* "nanchu" and the thinwooded *B. vulgaris* "Kwangin chu," commonly cultivated but less valuable as timber. These bamboo groves seem in most cases to be the result of deliberate cultivation.

Japan. — Although numerous species are indigenous, including no less than 17 species of *Arundinaria* and there are lands suited to bamboo throughout the country, the large quantities required for miscellaneous uses are mainly supplied from Formosa. *A. kurilensis* is the most northern known species.

Philippines (2). — 30 species. *Schizostachyum lumampao* ("caña bojo") treated by the soda process appear to be the most satisfactory paper material; an erect gregarious species sometimes 30 ft. high occupying considerable areas, averaging 9 000 canes per hectare, never cultivated.

Malaysia, Dutch east Indies — The common bamboo, *B. vulgaris* much cultivated in India, Mauritius, Cape Colony and Tropical America occurs both wild and cultivated from the plains to 3500 ft., in Java, Singapore, Celebes and the Moluccas. The spiny bamboo (*B. spinosa*) is abundant from Java to Borneo; the dwarf *B. nana* cultivated throughout the area, is half wild in Java and Singapore. Extensive forests composed almost entirely of *Gigantochloa maxima*, *G. ater*, and *G. aspera* occur, particularly at an altitude of 2000-4000 ft. *Dendrocalamus giganteus* which reaches a height of 120 ft. is also found and is very valuable; also *D. strictus*, *Dinochloa* spp. and *Schizostachyum* spp. which may prove as valuable as *S. lumampao* in the Philippines.

Tropical Australia. — No species seem to be abundant, 3 imperfectly known species have been described from the northern parts of the continent.

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(1) See *R.*, Oct-Dec. 1919, No 1144. (*Ed.*)

(2) See *R*, April 1921, No. 389. (*Ed.*)

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Pacific Islands. — The chief species indigenous to the Islands of the Central Pacific, from Hawaii to Samoa and Fiji is *Schizostachyum glaucifolium* 9 ft. high, often cultivated but not occuring in a markedly gregorious manner when wild; not yet tested as a paper material.

Tropical America and W. Indies. — Most of the bamboos of America belong to genera peculiar to the new world, *Guadua* taking the place of *Bambusa*, and *Chusquea* that of *Schizostachyum*, etc., only *Arundinaria* and *Nastus* perhaps being indigenous to both hemispheres, although some Asiatic species have become naturalised in the W. Indies. Many years ago a considerable quantity of paper pulp was annually made from *Arundinaria macrosperma* (reed bamboo) in North and South Carolina and the lowlands of the Mississippi. The utilisation of this species by modern methods is now under consideration in Louisiana.

Amongst the species of *Arthrostylidium* growing at high altitudes may be mentioned *A. racemiflorum*, in Mexico, *A. Schomburgkii*, the longest of the known bamboos in Guiana, and in the mountains near the sources of the Orinoco and Rio Negro. *Chusquea aristata* occurs in the same region in dense thickets. *Guadua angustifolia* forms forests several leagues in extent in hot valleys and at moderate elevations (about 2400 ft.) in Ecuador and Colombia, but the species of this genus probably more often occur in comparatively small thickets. In Trinidad, a considerable portion of the area occupied by gregarious bamboos is made up of introduced Asiatic species, especially *Bambusa vulgaris*, although *Guadua latifolia* (Venezuelan sp.) also occurs, and at high altitudes the large *Arthyrostylidium excelsum* and *A. pubescens* are found. Paper has for some years been made more or less completely from bamboo pulp in Trinidad. In Jamaica and British Guiana, bamboos do not at present occupy extensive continuous areas although there are evident possibilites in store.

IV. — *Brazil.* — A bamboo from Brazil was received by the Imperial Institute under the name of " tabocca brava " for examination as a source of paper pulp. The material was analysed with the following results %: moisture 9.8, ash 3.3, cellulose (expressed on cane as received) 49.9, cellulose (expressed on dry cane) 55.3.

A good yield of pale coloured pulp was obtained furnishing fairly soft papers. This, however, could not be satisfactorily bleached, but as the pulp possessed good felting properties, by adopting the sulphate method it seems possible to obtain white paper.

Africa. — The cultivation of bamboos, especially of species of *Phyllostachys* from the Himalayas has been suggested for Morocco and the coast of Algeria to fix sand dunes and dry up marsh land. *Oxytenanthera abyssinica,* the most widely distributed African species ranges from lake Tsana in Abyssinia to Liberia, Angola and Nyasaland, occurring at altitudes where snow is frequent. In W. Africa, with the exception of some small herbaceous species described from the Cameroons, bamboos are only represented by introduced Indian forms which are grown to a considerable extent on the Gambia. *Arundinaria alpina* occurs in the Kenya forests of E. Africa, and in Portuguese E. Africa. In S. Africa these are replaced by *A. tessellata*.

VII-XI. — *Madagascar*. — Several species of *Bambusa* have been successfully introduced in recent years and have been tested at Grenoble, France, and found to yield a satisfactory paper pulp. The following indigenous species are prevalent: — *Beesha capitata*, *Nastus* spp., *Cephalostachyum* spp. and *Schizostachyum* spp.

Conclusions: — The experiments so far made have clearly proved that a high class paper can be produced from bamboo pulp. On the whole it is too good for the manufacture of ordinary news-print, and is more suitable for better grades of printing paper. The cultivation of bamboo for paper pulp offers a number of advantages over spruce and other pulp woods. As bamboo culms are available for extraction within 8 or 10 years from the time of sowing, and if a proper system of rotation cutting is adopted, their cutting can be continued for a period of 30 years or more, that is until they flower. Propagation by seed and cuttings of half matured culms is relatively simple The latter are about 3 ft. long and should include, if possible part of the rhizome. They may be inserted vertically, with the 2 lowest nodes buried, or horizontally in prepared beds.

The occurrence of various native or introduced bamboos at various altitudes in many countries is sufficient to show that,, where they do not already exist in large enough quantities to be exploitable for paper pulp, there would be no difficulty in introducing and cultivating those species which have been proved suitable for this purpose

In connection with plants suitable for the manufacture of cellulose and paper, attention is drawn to the following interesting publication: — *Précis historique descriptif, analytique et photomicrographique des végétaux propres à la fabrication de la cellulose et du papier* (50 pl.), by MM. Léon ROSTAING, Marcel ROSTAING and FLEURY PERCIE DU SERT. H. Dunod & E. Pinat, Paris.

499 – **The Seeds of *Prunus brigantiaca* Vill. and their Oil.** — RAVAJOLI, L., in the *Bollettino dell'Associazione Italiana Pro Piante medicinali, aromatiche ed altre utili*, Year IV, No. 3, pp 38-41. Milan, March 1921.

The "*prunier des Alpes*" or "*marmotier*" (*Prunus brigantiaca Vill.* = *Armeniaca brigantiaca* Pers.), is a shrub growing wild in some parts of Dauphiné, especially in the neighbourhood of Briançon (hence its name of *brigantiaca*) and in the Piedmontese Alps. From the kernels of the fruits an oil is extracted, which is called "huile de marmotte," and is nearly all consumed locally. Cakes made of it are sometimes fed in small quantities to stock, but much care must be taken not to give more than a limited amount, as it contains hydrocyanic acid, and may easily prove poisonous.

A hundred grammes of the fruits contain about 145 stones (average weight 0.69 gm) 32 % of which are kernel and 68 % shell; the latter forms an excellent fuel, burning easily with the formation of but little ash (0.42 %).

The chemical composition of the kernels is as follows: —

	Per cent.
Water (at 100-105° C)	7.60
Ash	2.44
Crude protein	23.12
Crude fats	48.01
Crude fibre.	3.51
Nitrogen-free extract.	15.32

The ash of the kernels is very rich in phosphoric anhydride (35.57 % of ash = 0.87 % of kernels) and in potash; it gives a rather strong reaction of sulphuric acid, lime, and magnesia, and contains small quantities of iron oxide and traces of chlorine.

The kernels contain a small amount of organic phosphorous in the form of lecithin and lecithides; the content of the lecithin was: —

Free lecithin	16 per cent
Combined lecithin (lecithides)	0.21 per cent

The kernels contain 0.123 % of total hydrocyanic acid, and 0.048 % of preformed hydrocyanic acid. The combined hydrocyanic acid corresponds to 1.25 % of amygdalin.

The kernels also contain reducing sugars which calculated as glucose, amount to 4.3 %, and a few grains of starch; but their chief costituent is oil which amounts to 48 %.

By pressing as much as 35 to 40 % is obtained, it is of a light yellow colour and slightly bitter, with a strong smell of bitter almonds; its constants are as follows: —

Specific gravity at 15° C		0.9178
Refractive index (ZEISS-WOLLNY oleorefractometer)		64.5°
Thermic degree	TORTELLI thermometer	47° C
	JEAN	38° C
Freezeing point		19° C
Solidification point of fatty acids		7° C
Melting point of fatty acids		16° C
Refractive index of fatty acids		51°
Refractive index of acety lated fatty acids at 25 C		53°
Saponification index		194.9
Ester index		190.3
Acid Index		4.6
Index of free volatile fattyacids		0.5
Iodine index		89.4°
Acetyl saponification index (BENEDIKTS' metod)		218.8
Acetyl index		123.4
Acetyl acid index		95.4

"Marmotte" oil is consumed locally either pure or mixed with olive oil.

500 – **The Cultivation of *Fraxinus chinensis* in China.** — NOGARA, L., in *L'Apicoltore moderno*, Vol. 12, Nos. 1-2, pp. 3-8, 6 fig. Turin, January-February, 1921.

In compliance with the request of the *Apicoltore moderno*, the author, who is a member of the Institute of Foreign missions at Milan, sent from Lou-y-Lien Ho-nan, China, the following information accompanied by photographs.

The tree furnishing the wax is *Fraxinus chinensis* Roxb = *F. xanthoxyloides* Wall. It is planted in rows and allowed to grow to the height of 1 metre. Then it is cut down level with the ground every 2 or 3 years, and permitted to send up fresh shoots. Branches of 2 or 3 years of age no longer produce wax.

At the beginning of May, or a little later, are attached the eggs of *Coccus chinensis* West, which were collected the previous winter from *Fraxinus chinensis.* A small straw bag containing a dozen eggs is tied in the centre of the young tree which is all bandaged up. Two or three days after, the scale insect hatches out; it bites the branches in different places, and dies at the end of a fortnight. As a result of these slight lesions, a sort of white, odourless efflorescence 3 to 4 cm. thick exudes, which covers each branch extending from the point of its attachment to the trunk, to a height of 30 cm. In September, the lower part of the tree is completely white. The wax is then collected (it falls from the tree at a touch), and purified by being melted in boiling water, and then passed through a bag.

This plant-wax is used in a variety of ways; it is applied for staunching wounds, and is one of the ingredients of the mixtures employed in the manufacture of candles, to which it imparts greater consistency. The author by adding a little of this plant-wax to bees-wax, was able to make beatiful white candles, that did not bend even in great heat- (40°C.) and burnt slowly without guttering. This chinese ash grows in many places, but it does not produce wax everywhere. The product is very white in some districts, but in others it is always yellowish in colour.

Coccus chinensis is very common in some regions; in others it is rare, and only supplies local requirements. Before the war Chinese plantwax sold at 1 Chinese dollar (2 s. 1d. at par) per Chinese catty (1.50 lb.) now, its price is twice as much.

501 – **Sources of Turpentine and Resin: In India, *Boswellia errata*; In South America, *Cercidium spinosum*; In Australia, *Xanthorrhoea. spp.*** — I. A New Source of Turpentine and Resin in India, Commercial Importance of *Boswellia serrata* gum resin, *Bulletin of the Imperial Institure*, Vol. XVII, No. 2, pp. 159-177. London, 1919. — II. A New Resin from S. America *Ibid*, Vol. XVII, No. 3, pp. 296-297, — III. The Composition and Uses of Australian *Xanthorrhoea* Resin. *Ibid.* Vol. XVIII, No. 2, pp. 155-62, 1920.

I. — *Boswellia serrata* Roxb. — A summary of the information given by R. S. PEARSON and PURAN SINGH (*Indian Forest Records*, 1918, 6, p. 303) concerning the methods of tapping the trees, the preparation of the turpentine, rosin and gum, their chemistry, commercial value and industrial uses This investigation has shown that *B. serrata* gum-resin, which has hitherto been employed in India to a small extent chiefly as a substitute for *B. Carteri*, and *B. Frereana* in the preparation of incense, is capable of furnishing products of considerable commercial importance, and it seems probable that their preparation will constitute a profitable industry.

As a general rule old trees with black bark, dwarfed and suppressed trees, and trees with a short boll, yielded no gum-resin, and this was the case also with a large number of healthy trees of small girth. On the other hand, all sound and vigorous trees of 30 in. girth and over, all trees attacked by borers, or otherwise diseased, and generally all hollow trees, yielded well.

The average yield of gum resin per tree is as follows:

Girth of tree	Average yield
24-30 in.	0 9
30-36 in.	1 3
36 in. and over	1.9

In the Nimar Division, Central Provinces, 1023 trees tapped from January 21 to February 23, confirmed this statement.

The following conclusions as to the best methods of tapping were drawn from the results of experiments conducted in various localities :—

a) The method of tapping should consist in shaving off a thin band of bark about 6 in. broad, 2 ft. to 2 ft. 6 in. from the base of the tree,

b) tapping should be commenced in November and should stop before the break of the monsoon;

c) "freshing" should be undertaken every 4th or 5th day, and should consist in removing a thin shaving of ½ in. to 1 in. of new bark from the upper edge of the original belt, and carrying down the "freshing" to within 1 in. of the lower edge.

d) tapping of trees below 30 in. in girth is not advocated.

From the results of analyses of 8 samples collected at Khandesh during 1917, the average composition of the gum resin may be taken to be as follows: % moisture 10-11; turpentine oil 8-9, resin 55-57, gum 20-23, and insoluble matter 4-5.

II. — *Cercidium spinosum*. Tulasne.. — This small three related to the Caesalpinias grows abundantly in certain parts of the Goajira Peninsula, Colombia, and it is stated that the resin forms a layer on the trunk and branches of the tree, and that the roots, when exposed to the air, also become covered with resin.

The sample received at the Imperial Institute consisted of coarsely ground, translucent, yellow resin, containing brown particles of bark, and on examination gave the following analytical results:

Specific gravity at 17°/17° *C*	1.079
Moisture	1.3 %
Matter soluble in water	0.6
Matter soluble in hot alcohol	90.6 *
Ash	3.0

* The remaining 9.4 % insoluble in hot alcohol, consisted chiefly of bark.

The resin contained no volatile oil. The following results were obtained on examining the purified resin: melting point 77°C; acid value (mg. of potash per 1 gram of resin). 23.8; saponification value (ditto) 84.1, iodine value 85.8 %.

A varnish made of 1 part of purified resin to 1 part of turpentine gave a clear, pale straw coloured coat, but dried very slowly, the surface still being sticky at the at the end of 14 days. The general opinion was that the resin would not be suitable for the preparation of spirit, turpentine or oil varnishes.

III. — *Xanthorrhoea* spp. — The chief species yielding resins are: 1) *X. hastilis* R. Br. of Eastern and South Eastern Australia which yields a yellow resin known commercially as yellow gum acaroid, Botany Bay gum, yellow yacca gum etc,, 2) *X. arborea* R. Br. of Queensland and New South Wales. 3) *X. australis* R. Br. of New South Wales, Victoria and Tasmania 4) *X. Tateana*, F. Muell., of S. Australia 5) *X. Preissii* Endl. of S. W. Australia., all of which yield a red resin known as red gum acaroid, red yacca gum, black boy gum, etc.

The resins have been used to some extent in the past for making varnish, sealing wax, etc; and it was demonstrated many years ago that the resin could be used as a source of picric acid. A large number of experiments have been carried out with regard to the preparation of picric acid from both red and yellow resins and the possibility of using them as substitutes for shellac and rosin in the manufacture of lacquer for metals, of spirit varnish for wood,a nd of sealing wax; dyeing trials with these resins have also been carried out.

The results of preliminary experiments indicate that the yellow resin should yield at least 30 % picric acid, and the red resin at least 25 %, though on the commercial scale higher yields could probably be obtained.

Lacquers prepared from *Xanthorrhoca* resin appeared to stand exposure in dry atmosphere satisfactorily, but deteriorated rapidly on immersion in water. A 30 % solution of red resin in methylated spirit gave a fairly lustrous but dark coat on sized wood. The use of these resins for the preparation of lacquer or varnish is somewhat limited by the fact that it is insoluble or only partially soluble in turpentine, fatty oils, benzene or petroleum spirit, although soluble in alcohol The varnish showed however, better resistance to wear than rosin (colophony) varnish, although somewhat inferior to shellac in this respect.

It appears that ordinary red and yellow *Xanthorrhoea* resins could not compete in the United Kingdom with fustic or with artificial yellow or brown dyes.

The products obtained by the action of nitric acid on the resin under different conditions were picric acid, *P*-nitro-phenol, an amorphous nitro-compound and oxalic acid. The following products were obtained as the result of the action of oxidising agents on the resin:

a) Potassium permanganate: — oxalic acid about 40 %, acetic acid, small amount, carbonic acid, appreciable amount, vanillin about 0.2%.

b) potassium dichromate and chromic acid: principally an insoluble chromium compound.

An analysis of both kinds of resins gave the following resuls:

		Yellow	Red
Moisture (in vacuo at ordinary temperature)	%	3.0	3.5
Ash	%	1.3*	.24
Matter insoluble in alcohol (chiefly woody matter) ..	%	13-14	4
Matter insoluble in ether	%	23	16
Melting point (determined on the powdered resin in a capillary tube)..	%	97° C	110° C

* Including some sand.

502 – **The Economic Aspects of Cinnamon Cultivation in India and the Gold Coast.** — I. MENON, C. K. (Forest Ranger, North Mangalore Division, Economic Aspects of Cultivation in South Kantara in *The Indian Forester*, Vol. XLVII, No. 2, pp. 77-81. Allahabad, Feb., 1921. — I. Cinnamon Bark from the Gold Coast. — *Bulletin of the Imperial Institute*, Vol. XVI, No. 2, pp. 146-147. London, 1918. — III Further Investigations on the Value of Cinnamon Bark from the Gold Coast. — *Ibid.* Vol. XVII, No. 2, 1919.

I. — In the coast district of South Kantara, Cinnamon (*Cinnamomum Zeylanicum*) grows abundantly at elevations varying from 100 to 700 ft., and up to 3500 ft on the Ghat slopes. It thrives on any kind of soil except that in which sand predominates, and can stand any amount of rainfall. It flowers in January, the fruit ripens in May, and every few years bears a heavy seed crop.

The propagation of this species can be taken in hand without much difficulty as extensive areas in the Government unreserved forests which now contain only poor growth, can be brought under cinnamon cultivation by dibbling in seeds of the bitter and pungent varieties or by broadcast sowing. Cinnamon growth could thus be concentrated within small and compact areas, and instead of auctioning the same areas annually, the district sold during one year would be resold only after 3 years. A sustained yield of leaves for oil extraction, bark and fruits can thus be maintained.

The medicinal use of cinnamon is now being recognised, especially, with regard to cholera.

The author states that now that the formation of utilisation circles is under contemplation and at least one province, *viz.*, the UnitedProvinces has taken the lead, it is expected that others will follow this example, and it is hoped that this industry will claim the attention of experts in the area under discussion.

II. III. — An analysis of samples of cinnamon bark sent to the Imperial Institute, coming from (*a*) Tarquah, (*b*) Assuantsi (*c*) Coomassie, Aburi, on the Gold Coast.

It was ascertained that the entire oil (heavy and light fractions included) which would be obtained on distilling on a large scale should contain at least 68 % of aldehydes. The small scale distillation trial made with the bark in order to determine the yield of volatile oil, gave the following results:

	Samples			
	Tarquat %	Assuantsi %	Coomassie %	Aburi %
Heavy oil	1.18	1.5	1.6	1.4
Light oil	0.3	0.3	0.4	0.3

All four samples of heavy oil had a very fragrant aroma and closely resembled each other in this respect.

As a result of a chemical examination it was evident that all these barks furnish high yield of oil which contains a large percentage of cinnamic aldehyde. In both these respects the barks are superior to Ceylon cinnamon bark.

503 - **The Cultivation and Use of Buchu *Barosma betulina* in South Africa** — COMPTON R. H., and MATHEWS, J. W. (National Botanic Gardens Kirstenbosch), in *Journal of the Department of Agriculture, Union of South Africa*, Vol. II, No. 3 pp. 223-228, figs 3, Pretoria, March, 1921.

Owing to the increased interest taken in the cultivation of *Barosma betulina*, it was thought desirable to publish the conditions under which such satisfactory results have been obtained at Kirstenbosch, with conclusions drawn from observations thereon. The future prospects of buchu as a field crop are bright as the demand for the herb and oil is increasing rapidly throughout the world. Under distillation buchu yields a resin and also a volatile oil, and according to the analysis made by THOMPSON the followed are the yields for the three commercial varieties, calculated as percentages of the weight of dried leaves: —

	Resin	Oil
B. betulina	4.25	1.45
B. crenulata	3.75	1.6
B. serratifolia	3.45	1.0

The oil can be obtained from green leaves as well as from the dried herb, and it has been estimated that the yield of oil from green *B. betulina* leaves is about 1 %, and the green twigs give a yield of about 0.5 %. As the herb loses about half its weight in drying, it is clear that a considerable waste of oil takes place in this process. The most economical way of extracting oil, therefore, would be by distillation of the green shoots shortly before cutting. The oil derived from *B. betulina* leaves is a clear-yellowish mobile liquid, which deposits a mass of colourless needle crystals of diosphenol or " Barosma camphor " when it is cold. The oil from the twigs is inferior, no diosphenol crystallising out on freezing. The oil from *B. crenulata* leaves is also deficient in diosphenol. The volatile oil, taken internally has a marked effect on the mucous membrane and is therefore employed in the treatment of various diseases.

At Kirstenbosch " dry " cultivation is practised and is generally the most suitable for the western and south-western districts. Deep trenching is essential to encourage drought resistance and the longevity of the plantation. The soil there is a deep red sandy loam, rather adhesive when wet, and caking somewhat on drying; the subsoil is a reddish clay with occasional seams of iron-stone and quartz gravel. The authors consider that good peach, apricot, vine or hillside lands would suit buchu well.

Sowings should be made in drills 1 inch deep and 3 ft. between the lines, seeds 2 or 3 in. apart. Germination takes place in about a month but is invariably poor, the average being from 40 to 50 %. About 7 lb. of seed are required per acre. Propagation by cuttings is being tried this season.

At a year old the plants can be cut back to 3 in. from the ground to induce a bushy habit, and at 2 years cut back again from 1 to 2 in. above previous year's cut, and so on annually, the resulting bush slowly increasing in surface area and yielding a maximum of leafy twigs.

The best time for harvesting is March or April, as soon as a rain has washed the foliage clean, and buchu should not be collected by breaking off the branches as has often been done and which causes injury or death of the plant. Drying should be done as quickly as possible, and to keep a good colour it is essential that this should be done in the shade. A corrugated roof, with open sides, or latticed with spars or leafless branches would approach the ideal. The dried buchu should be as green as possible to avoid loss of oil content. For export purposes the buchu should not contain more than 10 % of the small green twigs and none of the larger ones.

To secure a crop of seed from cut-backs, it is necessary to allow the bushes to develop unchecked and uncut for 2 or 3 years.

The National Botanic Gardens will be pleased to identify any specimens sent of the varieties of buchu occurring wild; correspondents in the Union can send specimens of seeds free by post or rail if addressed O. H. M. S. to the Director. Seed is distributed from this centre on application may be available, preference being given to Members and Associates of the Botanical Society of South Africa.

504 – **Cultivation and Manufacture of Tobacco in Mauritius.** — *Bulletin of the Imperial Institute*, Vol. XVIII, No 2, pp. 252-256 London, April-June, 1920

The results of experiments conducted in 1916-17 with Réunion tobacco in Pamplemousses Botanic Garden, and in two other localities in the island have already been reported (1) In the 1917-18 season, 3 acres were planted at Pamplemousses, 3 acres at Riche Terre and ½ acre at La Ferme.

These trials have indicated that the " tabac bleu " is more resistant to disease than types of Virginia, Sumatra and Turkish Tobaccos tested previously, although to a certain extent subject to attack. It is estimated that 100 plants will yield about 5 kg. of seed. Tobacco plants of the Réunion type appear to be particularly sensitive to water, and provided that the rainfall is fairly evenly distributed throughout the year, irrigation is not necessary. In general, the best months for planting in Mauritius are apparently December to February. The plants are mature about 4 months after being planted out in the field, and after being cut off within

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(1) See *R.*, September 1918, No 993 (*Ed*)

3 or 4 in. of the ground, a crop of ratoons may be allowed to arise from the stumps; but their production rarely exceeds 1/8 of that of the original plants, and it seems probable that if ratooning is practised it will not be profitable to harvest more than one ratoon crop.

The yield of green leaf varies greatly with local conditions but may be said to average 3 ½ to 4 tons per acre.

The yield of cured carotted tobacco (a carotte consists of a torpedo shaped bundle 18 to 22 lb. in weight, covered with a wrapping of dry banana leaves, known as "empondres" and tightly bound round with sisal cord.). amounts to about 10 % of the weight of the green leaf, and the manufactured tobacco to about 34 % of that of the first mentioned type or 3.4 % of the weight of the green leaf.

505 – **The Process of Ripening in the Tomato, Considered Especially from the Commercial Standpoint in Florida U. S.** — SANDO C. E., in *United States Department of Agriculture, Bulletin* No. 859, pp. 1-38, pl. 4, tables 10, figs 3, bibliogr., of 58 works, Washington D. C., Sept., 7, 1920.

With the object of discovering the chemical basis for the inferiority of commercially picked and ripened Florida tomatoes marketed in the north during winter and spring, a series of analyses were made of tomatoes of several degrees of maturity, and of others ripened artificially under various conditions of ventilation. The fruit employed was obtained from plants of the Livingstone Globe variety grown at Peters, Dade County (Fla)., which is almost exclusively used for winter shipping to northern markets. These plants were set out in January, and had the same treatment as the commercial plantings.

It was found that the only way to secure samples of comparable maturity for analysis was to tag the blossoms and pick the fruit at a definite age, as maturity is dependent upon age and not size, and ripening proceeds at a uniform rate.

The analyses indicate that in general throughout the ripening period there is an increase in moisture, acids and sugars, and a decrease in solids, total nitrogen, starch, pentosans, crude fibre, and ash. The most striking change is that undergone by carbohydrates. In the first stage it was noticed particularly that insoluble carbohydrates composed 52.1 % of the total carbohydrates present, while in the last stage, that of ripe fruit, soluble carbohydrates were in excess, amounting to 77.3 % of the total. Nearly all the total sugar is apparently invert sugar and this increases from 25.56 % in the case of 14-day old fruit to 48.32 % in ripe fruit. Starch decreases during maturation from 15.84 % to 2.65 %. The most marked decrease takes place during the period of transition from green to red. Pentosans decrease, but only to a comparatively slight extent. Total nitrogen decreases gradually during ripening, and the correlation between this and total carbohydrates holds good with respect to other fruit as well as to the other parts of the plant (excluding the lower leaves).

The percentage composition of fruit picked green but ripened with free access of air and light differs only slightly in composition from naturally ripened normal fruit, and contain more sugar-free solids, slightly more acid, and less sugar than the latter.

The effect of lack of ventilation on ripening is to increase the acid content approximately 138 % over that of normal fruit. The flavour of tomatoes ripened without ventilation is very inferior. The soluble carbohydrate content showed a decrease of nearly 21 %. Commercially ripened green fruit, wrapped with one layer of paper, shows an increase in acid of approximately 102 % and a sugar decrease of nearly 5 % compared with corresponding tests of normally ripened fruit. The results of wrapping with 3 papers are less marked, the acid increase being only about 58 %.

The data presented also indicate the fact that green tomatoes ripened when exposed to air and unwrapped are superior in taste and chemical composition to the same fruit ripened when wrapped in paper. The combined results of picking fruit green, of wrapping, and of closing the cars in transit probably account for the total differences existing in quality between commercially shipped and normally ripened tomatoes.

506 - **Fruit Cultivation at High Altidudes in Colorado U. S.** — McGinty, R. A., in *Colorado Agricultural Experiment Station Bulletin No.* 256, pp. 1-19, figs. 8, Fort Collins, Col., 1920. (Abstract in *Experiment Station Record*, Vol. 44, No. 3, pp. 234-235. Washington, 1921.)

A progress report on experiments with orchard and small fruits and vegetables that have been conducted at the Fort Lewis School of Agriculture a branch of the State Agricultural College, since the spring of 1916, The work is being conducted primarily to secure information relative to varieties and cultural practices suited for the short growing season in the high altitudes of Colorado. The altitude at the school is slightly more than 7 600 ft., and frosts occur as late as June 10 and as early as September 1.

No definite conclusions are drawn from the orchard work thus far, as the trees, which consist of several varieties of apples, crab apples, plums, and sour cherries, have not come into bearing, with the exception of a few fruits on some of the plums and cherries. Indications are that the chief trouble will be blossom destruction by late spring frosts. Rabbits also cause serious trouble by eating the bark on scaffold limbs during the prevalence of deep snows. The trees themselves are apparently as hardy as elsewhere in Colorado.

The work with small fruits has been handicapped by poor planting material. Thus far, however it appears that strawberries should succeed if well mulched with straw in the fall. Raspberries give promise of some success if the canes are covered with earth in the fall. They are apt to suffer from late spring frosts, and the cover should be gradually removed in early spring in order to harden the young growth, and also to prevent the development of spindling shoots under the earth cover during a warm spell of weather. Gooseberries and currants appear to be well suited for cultivation in high altitudes on account of their hardiness and late blooming habits.

507 - Cultivation of Date, Pomegranate, Crab Apple, Guava, and *Grewia Asiatica* as Practised near Shikarpur, Sind, India. — BARAKZAI, M. U. F. (Agricultural Department, Sind, in *Department of Agriculture, Bombay, Bulletin*, No, 98, pp. 1-14. Bombay, 1920.

Shikarpur is a famous centre for fruit-growing and contains about 150 orchards covering an area of 868 acres. This area is divided among the different fruits as follows (acres): date palms 230 — mangoes 167 — pomegranates 139 — oranges and lemons, 135 — *Grewia asiatica*, 91, miscellaneous (peaches, apples, guavas, jujubes (" ber ") 106. The author confines his attention in this case to the cultural details concerning the less well known species: —

I. — EDIBLE DATE. (*Phoenix dactylitera*). — Attention is drawn to the fact that sandy loam is probably the best medium for successful cultivation of the date palm, although it is not uncommon to find it flourishing in heavy clay and even in salt soils. Transplanting suckers is the most advisable method of propagation. Sowing seed is not practised, as most of the seedlings thus obtained appear to be males, and the few females that remain do not possess the characteristics of the parent.

In the first 3 years after transplanting, irrigation is necessitated. During the first quarter. — April-June, well water is applied every alternate day in order that the seedlings may strike root. From July onwards, weekly applications are sufficient.

Direct manurial or intercultural treatment is not adopted, nor is it advisable, but the intermediate spaces are ploughed and manured to grow vegetable crops, seedlings of fruit etc. A yard round each palm the earth is well beaten and a mound raised to enable the plant to withstand high winds.

The eighth year is considered to be the average year from which an appreciable quantity of fruit should be obtained. Each palm produces from 10 to 30 fruit stalks; in better varieties, 10 spathes only are allowed to fruit, the rest being cut off to support the development of the remaining fruit to their maximum capacity. (Each bunch yield from 10 to 40 lb. of dates. The total yield per plant ranges between 100 to 400 lb.). The fruit season lasts from May 15 to October 15. The fruit appears in the market in 3 shapes 1) unripe and acid " khasoon " (made edible by keeping them in closed earthem jars in a hot room for a night) 2) secondary stage sold as " doka " (80 lb. of doka to which ½ lb. common salt and 3 lb. water are added in earthem jars, for about 2 hours in the evening then placed in a close room for a night, are converted into the soft, sweet dates " luni-kharkun); 3) ripened on the tree " van pakyun ".

Parrots, sparrow and crows are common bird pests. No fungus or insect disease is known to occur in the locality of Shikarpur.

All parts of this palm except the roots are used for industrial purposes: leaflets for fans, matting, brooms and baskets; whole leaves for well ropes; dried fruit stalks for brooms and bird cages; fibrous material for ropes and stuffing for pack saddles, etc.

II. — POMEGRANATE " Anar " (*Punica Granatum* L.). — Eighteen months after making and planting cuttings the land selected for the plantation is irrigated, ploughed twice, levelled and laid out in small plots $1\frac{1}{4}$ to $1\frac{1}{2}$ acres in size. Parallel furrows 12 × 18 in. are made 12 ft. apart. Along each channel and on one side only, circular holes are dug; these are left exposed for about 10 days, the excavated earth mixed with 50 lb. cattle manure, and turned into the pits. Irrigation is given about twice a week at the start, but when farily established water is applied once a week thoughout the year (interval shortened if white ants are troublesome). Along the borders of the channels are sown *Momordica Charantia, Luffa acutangula, Hibiscus esculentus.* Other crops sown in the plantation are chillies, *Rumex acetosa, Trigonella Foenum-graecum* etc.

These crops are only cultivated during the first three years, when the pomegranates begin to yield. At this time also, weeding is stopped and the growth of natural grasses is encouraged as these provide an excellent green feed for cattle. The following weeds are found on these plantations, all serving as use ful feeds : — *Eragrostis cynosuroides, Eleusine flagellifera, Cynodon Dactylon, Panicum colonum, Cyperus rotundus, Digera arvensis,* and *Andropogon annulatus.*

From 5 to 50 years, maximum yields are obtained. The average number of 'Anars' borne by each plant is 70, each of which weighs from $\frac{1}{2}$ to $^3/_4$ lb. In the locality in question, 12 varieties (6 sweet pulped and 6 acid) are commonly grown, and all command a ready sale. Apart from the use of the fresh fruit, the syrup is used as a febrifuge; dried rind and flowers in wool colouring; unripe flowers dried and pounded to make snuff; green leaves as a medicinal paste-bark in several medicinal preparations.

III. — CRAB APPLE "Soof" (*Pyrus malus* L.). — This differs from the well-known variety in other countries in the fact that it is neither so big nor so sweet flavoured. This fruit appears to have a short life extening over 20 years or so; the yield of ripe fruit ranges from 20 to 60 lb. per tree, with an average of 30 lb. per plant.

IV. — GUAVA "Zetoon" (*Psidium Guava* L.). — A fully ripe fruit picked from the tree and crushed to squeeze out the seeds. These are then mixed with dry rotten but powdered cowdung, and sown in a 10 ft. square nursery bed, usually in March or August. Germination occurs within about a month. Irrigation is given every 5 days. The same methods of cultivation are employed as for the pomegranate, and also the catch crops are identical. The hollow made opposite to each plant along the other border of the furrow is dug $\frac{1}{2}$ ft. deep and 20 lb. farmyard manure applied, in February or March.

Each plant yields on an average 30 to 40 lb. of fruit : 60 lb. being the maximum yield. There are 3 varieties usually growing in the gardens: 1) Khasi (seedless), 2) Vanga · (elongate); 3) Gedi (small fruited).

The fruit is the only useful marketable product of the plant.

V. — "PHARWAN" (*Grewia Asiatica*). — A small but very productive perenennial shrub. Ripe berries, collected during May are mixed with fresh moist cowdung and kept in a jar for 2 days, then sprinkled on small ridges 9 to 12 in., apart. Irrigation is necessary every alternate day. The seedling are transplanted after 3 years, after preparing the land as described for pomegranate. After transplanting (March-April), irrigation is given at an interval of 3 days during the summer and of 6 days later on and none during the winter. All shoots of full grown plants are annually pruned down to the stump in January. The plants fruit 5 years after sowing, and each plant yields from 20 to 25 lb. ripe berries.

The berries provide a useful fruit during the hot weather, and the leaves and branches are also used for various local purposes.

508 - **New Variety of Prune Suitable for Growing in the South-Eastern United States.**— See No 486 of this *Review*.

509 - **Some Facts and Figures Regarding Banana Cultivation in India.** — BURNS, W., (Economic Botanist, Bombay) and DANI, P. G., (Bombay Agricultural Department) in the *Agricultural Journal of India*, Vol XV, Pt. IV, pp 386-392. Calcutta, July, 1920.

Records of two plantations in the Ganeshkhind Botanical Garden The two varieties used were: 1) "Soni" (local name) with a medium sized very sweet, yellow skinned fruit and 2) "Rajeli" ("Rajapuri" or "Gujarathi"), more dwarf in habit and with a more angular and slightly coarserfruit.

The yield of raw fruit for the plantations was as follows:

Variety	Date	Weight per acre	Number of fruits per acre
I Soni	June 1915 — March 1919	27194 lb	140984 lb.
II. Rajeli	June 1916 — March 1919	23085 »	86050 »

The average yield per sucker (mother or daughter) during the period of Experiment I was 31.65 lb. in weight or 164 fruits in number, and the average number of days required was 1 year, 3 months and 7 days from the date of planting to the date of fruiting. From the date of harvest of the mother to that of the next generation the interval was 280 days. The yield in the 1st generation was more by an average of 72 fruits than that of the mother, and still more by an average of 3 in the 2nd generation than in the 1st (here the average of the three stools is taken).

In Experiment II, the average yield per sucker was 21.27 lb. or 79 30 fruits and the date of planting to the date of fruiting covered 1 year and 45 days, with intervals of 244 days from mother to 1st generation and 119 from 1st to 2nd generation. There was an average increase of 46 fruits in the 1st sucker generation and an average decrease of 44 fruits in the 2nd generation.

A manurial experiment was carried out, one part treated with a mixture recommended by Dr MANN and the other receiving local treatment. The results have been recorded in the *Annual Report of the Ganeshkhind Botanical Garden for the years* 1915-16, 1916-17, and 1917-18 and in *Bulletin No.* 89 *of the Bombay Agricultural Department.*

The following calculations show the probable profits from the cultivation of the "Soni" variety in the Poona District.

Cost of Cultivation.

Cost of labour, man charged at rate of 8 as per day
woman, child " " " 4 " " " "
and bullock.

Farmyard manure at Rs 2. per cart and poudrette at Rs. 2-4-0 per cart.
Two cart loads are equal to 1 ton (2.240 lb).
One basket is " " 20 lb.
56 baskets 1 cart load.

(The whole time of the existence of the plantation is taken as three years and six months).

The following are calculated per acre.

EXPENDITURE

	Rs.	A.	P.
(1) Two ploughings crosswise by an iron plough CT2 or Arlington, two pairs and two men for 4 days	8	0	0
(2) Disking and harrowing, one pair and one man for the whole day . . .	1	8	0
(3) Digging pits; size 2 x 2 x 2 1/2. Pits required for an acre 15 feet apart are 193. One man digs 5 pits in one day, 39 men finish the work in one day	19	8	0
(4) Suckers required 200, at the rate of Rs. 10 per 100	20	0	0
(5) Manuring at the time of planting, F. Y. M. 80 lb. per plant (14 cart-loads required)	28	0	0
(6) Carting manure at R. 1 per cart.	14	0	0
(7) Planting suckers; one man plants about 25 suckers in one day . . .	4	0	0
(8) Harrowing and levelling after planting.	1	0	0
(9) Preparation of beds and water channels, one man prepares about 16 beds of the size required per day	6	0	0
(10) Irrigation charges: water generally given for 10 months in a year excepting rainy season; 30 waterings in all for one year. Irrigation Department charges per acre Rs. 22-6-0 for crop like plantain (G. R. N° 6371, dated 27th June, 1917), for three and half years	78	12	0
(11) Watering charges; in all 105 waterings for the whole time of the plantation; one man can irrigate one acre in a day	52	8	0
(12) Stirring, digging and weeding the beds once every three months 12 men can finish it in one day. 14 such operations	84	0	0
(13) Manuring: Generally manured every six months. For the method of manuring as described, the total cost comes to	173	10	0
(14) Land assessment to Government for three years at the rate of Rs. 4 per acre.	12	0	0
(15) Rent of land on lease for three and half years at the rate of Rs. 20 per acre..	70	0	0
(16) Harvesting charges; per bunch 3 pies, for 868 bunches	13	9	0
Total cost.	586	7	0

INCOME

	Rs	A.	P.
Yield per acre in number of fruits, 140984; sold wholesale on the plot itself at Rs 10 per 1,000	1 109	13	0
Subcrop like chillies, etc., taken for the first six months The net profit per acre for such a crop comes to.	50	0	0
Spare suckers sold at the rate of Rs. 10 per 100..	52	0	0
Total income	1 511	13	0
Deducting cost of cultivation	586	7	0
We get a net profit for three and half years.	925	6	0
So, for one year, the net profit for banana cultivation is. . . .	265	0	0

510 - **Means of Promoting the Root-Development of Vine Cuttings in the Nursery.** — PROSPERI, V., in *La Propaganda Agricola*, Series II, Vol. III, No. 3, pp. 33-36, Bari, February, 15, 1921.

In exceedingly dry years, few of the cuttings of Berlandieri and its hybrids take root. In some plantations of Berlandieri × Riparia 420 in Apulia, scarcely 15 % of the cuttings made roots, which means at the present prices, an outlay of over 20 000 *lire* per hectare merely for the purchase of ungrafted vines. In making a vineyard of this variety it is necessary to have cuttings with a well-developed root system.

In order to promote the development of the root system, the author recommends a special treatment of the cuttings which has long been practised in Apulia, and always given good results, although it has been considerably criticised. The treatment is carried out as follows:— The base of the cane that is to be planted must be kept immersed in a basin of water for 4 or 8 days, and then put into light soil, until the time when it is planted in the vineyard.

The author has found that roots develop on cuttings thus treated much more rapidly than on those planted immediately after being taken from the vine. It is also a good way of obtaining ungrafted, well-rooted cuttings, especially in the case of vines which root with great difficulty.

As soon as the cuttings are planted, they must be watered. and the operation should be repeated after some weeks, if the weather continues dry. In the spring of 1920, two adjoining plots were each planted with 11 000 cuttings of Berlandieri × Riparia 420 on the same date (March 1-2); one was not watered while the other was liberally watered on May 5 and at the beginning of April. From the middle of May, both plots were watered periodically, and to the same extent. The number of cuttings that took root was 34 % in the case of the first plot, and 76 % in that of the second.

The author summarises the rules to be observed in making wild cuttings as follows:—

1) Choose suitable soils.

2) Take a well developed cutting of the average length of 45 cm., remove all the buds except that at the extremity which is to make the shoot.

3) Trim the lower end with scissors at the level of the node.

4) Twist the cutting till the cracking characteristic of woody tissues is heard.

5) Keep the cuttings in a basin full of water for 2 hours before planting them.

6) Cover the basal portion of the shoots, when planted, with dung (to which has been added superphosphate and a potassic fertiliser) mixed with soil.

7) Do not put off watering later than the first half of March, and repeat the operation several times before the want of moisture in the soil causes growth to proceed slowly.

511 – An Economical and Rational System of Supports for Nurseries of American Vines.

— ERRICHELLI, E. (Antiphylloxera Consortium of Trani), in *La Propaganda Agricola*, Vol. XIII, No. 2, pp. 25-29, 1 pl. Bari, January, 31, 1921.

It is an undisputed fact that some support should be given to vine stocks but the system which is most economical and at the same time most adapted to the physiological reguirements of the plants has not yet been decided upon. The system generally adopted in nurseries of American vines, namely the arrangement ot the vines in pyramids with a central stake flanked by reeds, is very expensive, and does not encourage the free growth of the canes, so much so that some growers state that American vines produce better grapes when grown without any props, and allowed to spread along the ground.

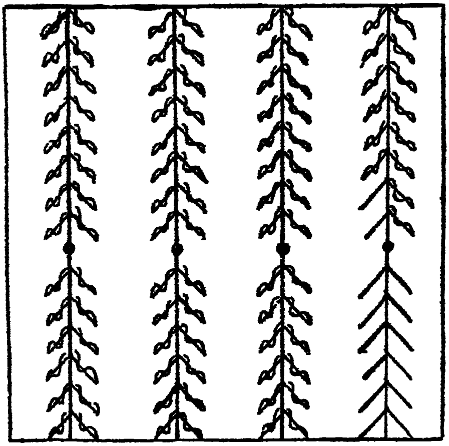
The author suggests a system. which he calls "*a spina*": by this a considerable saving is effected as compared with that of the pyramidal support, and at the same time if the rows face towards the south, the vines enjoy more unitorm and intense insolation, whereas if some other exposure is chosen, the plants are better sheltered from the heat of the sun.

The system is as follows:—

If the stocks are planted from 1.40-1.60 m. apart and in a square, galvanised wire (No. 16 is excellent) is extended between the rows, and attached to a stake at every 25 metres. At either end of the row, a stronger stake is driven in, and fastened into the ground with chains; these stakes need not be more than 8 to 10 cm. in diameter. The vines must be good runners, as otherwise they weigh down the wire arch, and bend it out ot shape. The opposing tension exerted by the arch upon the trellis counterbalances the pull of the longitudinal wire itself. At the foot of each stock, a reed is driven into the ground, the other end being tied to the wire arch in such a manner that it meets the corresponding reed of the opposite row and forms an acute angle with the ground. The slope of reeds thus placed is the same as in the pyramid system.

When the vines canes are tied to the reeds, long "berceaux" are made, from which old or new alleys can branch off without interrupting the course of the longitudinal wire; the wire is placed at such a height as not to interfere in any way with the necessary cultural operations.

The following diagram shows the arrangement of the vine-props just described:—



The cost of trellising 1 hectare of land with 3969 vine stocks arranged in a square (at intervals of 1.60 m.) is shown below.

PYRAMIDAL SYSTEM (WITH SQUARE BASE)

993 trellises for 3969 stocks of 2 *lire* each	Lire	1 984.00
3969 reeds at 80 *lire* per 1000	»	317.52
Carriage of trellises	»	45.00
Sulphate of copper for treatment at 335 *lire* per quintal allowing 6 kg. per 100 trellises, = 59.58 kg	»	199.59
Labour employed 12 days at 12 *lire*	»	144.00
Putting up trellises, 60 days at 12 *lire*	»	720.00
Inserting reeds and tying vine-canes: 40 days at 12 *lire*	»	450.00
Total . . .	Lire	**3 890.11**

If 12 years is reckoned as the duration of this trellising, the annual amortisation (at 4 % would be about 584.45 lire. This allows for the additional expense of renewing the reeds every 4 years (2 renewals), at the cost of 1595 lire.

" A SPINA " SYSTEM.

62 end stakes at 3.40 lire each	Lire	210.80
93 intermediate stakes at 2 lire each	»	186.00
3969 reeds at 80 lire per 1000	»	317.52
Galvanised wire No. 16 at lire 438 per quintal: for the 3 100 m. required, about 132 kg	»	578.16
Carriage of stakes and wire	»	15.00
Sulphate of copper (allowing for larger absorption by the end stakes) 9.54 kg	»	31.95
Cost of labour employed: 2 days at 12 lire	»	24.00
Fixing the end stakes, the intermediate stakes and the wire: 12 days at 12 lire	»	144.00
Inserting the reeds	»	480.00
Total . . .	Lire	**1 987.43**

If the duration of these supports is reckoned at 18 years with the additional expense of 3190 *lire* for replacing the reeds 4 times, the annual amortisation at 4 % would amount to about 408.95 *lire.*

On comparing the two systems it will be seen that the adoption of the second means a saving of about 50 % or 1900 *lire* per hectare.

The system could be modified by using a double number of reeds, *i. e.*, by arranging them so that the tops formed an angle at the foot of the vine-stock, the two upper ends being fixed to the wire so as to make a V leaning towards the latter. In this way, the canes of the same stock would be divided between the two reeds

Such an arrangement would entail a little more expense, but even then, the "spina" system would be much cheaper than the pyramid. It has, moreover, the additional advantage of allowing the vines to grow under the best conditions for their development, for as they have more space at their disposal, they will not be obliged to compete with one another for air, light and heat.

512 – **The Sirah Vine in Italy.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Vol II, No. 4, pp. 49-51. Alba-Leghorn, April, 1, 1921.

The author states that this stock is well worth a trial in new vineyards, and also advocates its cultivation on a larger scale in Italy. It is a French vine that is a great favourite in its native country, but is less grown in Italy, having hitherto only been introduced into the Marches, the Province of Caserta, at the Royal School of Viticulture, Avellino, and in Piedmont. In the three first districts, it has given satisfaction, bud in the fourth, it is not much liked, on acount of its small yield as compared with the local varieties of vine.

All regions with a temperate climate (North and Central Italy, the southern part of Campania on the slopes facing the Tyrrhenian Sea) suit this vine admirably It escapes the white frosts in spring, as it shoots late; it is not subject to non-setting, and its yield is constant Sirah is very resistant to oidium and mildew, and when it does fall a victim to fungoid attack, this occurs at a later date than is the case in more susceptible varieties; further, it is but little affected, therefore treatment is more successful and less expensive. For these different reasons the Sirah vine is much liked in the colder parts of the Avellino district (Forino and Avellino), where the local varieties ripen late and sometimes inperfectly, whereas Sirah (2nd maturation period) often produces a must containing 20 % of glucose.

Its grapes rot easily, therefore this vine must not be closely planted, and should be grown on dry soil with a good exposure, and kept well off the ground. This can be done easily. as it grows very well trained on the maple, as is the custom, for instance, at Potenza Picena, in the Province of Macerata.

In Piedmont, the wine made from the Sirah grapes is less acid than the product of the local varieties; in Tuscany, its good qualities are much appreciated; when the vines grow on calcareous soil, the wine has a high alcohol content, is highly-coloured, and has a fine bouquet.

Sirah does very well when grafted on Riparia, but for dry calcareous soils, 3309 and Rupestris du Lot are preferable.

A large and a small kind ot Sirah are grown, which differ in the size of the grapes and their glucose content; this is higher in the small-berried sub-variety.

513 - **Early Ripening Table Grapes for Cultivation in Apulia, Italy.** — PROSPERI. V., in *La Propaganda agricola*, Series *II*, Year XIII, Nos. 5-6, pp 65-67, Bari, March, 15-31, 1921.

Before phylloxera made its appearance, the cultivation of table-grapes was already a thriving industry in the provinces of Bari and Lecce; the grapes sold wère mostly those of a very early vine, known as "turchesca" in the former province, and "uva rosa" in the latter The more widely extended cultivation of this variety, and the introduction of other kinds which ripen sooner and answer the requirements of the vine-growers better, would be a great advantage to Apulia For this reason, the Government Nursery of Barletta has for the last ten years been studying some of the best known varieties of table-grapes. Of these there are 20 at the present time. The author mentions three: — 1) "Saint Anne of Leipzig"; (2) "Violet Chasselas"; and 3) "Musk Chasselas", which in 1920 (a hot year when grapes matured early) ripened respectively on July 7 July 22, and August 5 (the last being the date of the ripening of the "turchesca" grapes).

In the Bisceglie district, which is the centre of the cultivation of table-grapes, the "turchesca" variety ripens ten days sooner than in Barletta, hence it is likely that the three above-named varieties would also mature there a few days earlier.

The vineyards were planted in 1914-1915 with shoots grafted on Berlandieri × Riparia 420-B., and raised on cordons with spurs. Up to the 4th year of bearing, these vines have shown no signs of bramble-leaf "roncet", a disease to which the "turchesca" vine is very susceptible.

514 - **A Direct Vine Bearer Resistant to Drought the 4643 Seibel.** — CROUZAT, L., in *Revue Agricole de l'Afrique du Nord*, Year 19, No. 80, pp. 115-116. Algiers, Feb. 11, 1921, and in *Le Progrès Agricole et Viticole*, Year, 37, Vol. 74, No. 5, pp. 106-107, Feb., 1, 1920 and Year 42, Vol. 73, No. 2, p. 48. Villefranche (Rhône) Jan., 9, 1921.

For the last 4 or 5 years, the author conducted an experiment on an area covering 5000 to 6000 ft. in several parts of the Department of Aude with the grape variety 4.643 Seibel.

In 1919 and 1920, both noted for excessive drought, the most resistant of all the vine stock in all the vineyards, was found to be 4.643 Seibel and the only vine which apparently did not suffer from the drought was the same grafted on Rupestris du Lot, growing on poor and stoney soil noted for its dryness

In addition to this, in 1920, on the borders of l'Etang de Bages, this variety did not appear to be affected by the salt content, very virulent at the time; in certain plots, the author had observed Carignan species completely defoliated in August.

S. 4643 is a black variety late ripening, excellent yield, giving superior quality wine It is necessary to employ a sulphur wash, and in unfavourable years, one or two sulphate washes. Information has been received from the Gold Coast that in 1920, without this treatment. the leaves were affected with mildew, but the grapes remained undamaged.

Grape resistance is apparently always stronger than leaf resistance.

Success as a result of grafting has been remarkable in every case, the average intake being never less than 94 %. On all the plots under consideration, the branches developed normally with the usual annual spraying (2 sulphate and 2 sulphur).

The proprietors of the 8 plots have grafted this variety quite ignorant of its qualities, and now wish to propagate the same more widely. Their trials were conducted quite apart from each other, but they are all of the same opinion that 4643 is extremely resistant to drought. This was confirmed in 1919 and 1920; what is more, the salt sea winds apparently have no ill effects on on this variety.

515 - **Effect of Late Spring Frost Upon Forest Vegetation in Utah, U. S.** — See No 472 of this *Review*.

LIVESTOCK AND BREEDING

516 - **Diseases of Live Stock in the Northern Territories of the Gold Coast.** — See No 472 of this *Review*.

517 - **The Use of Copper Compounds in the Treatment of Parasitic Broncho-Pneumonia Caused by *Strongylus*.** — VON LINDEN, in the *Deutsche Landwirtschaftliche Tierzucht*, year XXIV, No. 36, pp. 367 368, and Year XXV, No 7, p. 71, Berlin, September 1920 and February 1921.

The treatment advocated by the author is based on experiments extending over ten years.

I. CURATIVE TREATMENT. – Soluble copper compounds may be administered by way of the mouth, or in the form of intra-venous or intra-muscular injections.

The ingestion treatment consists in giving the animal sodium chloride. mixed with 1 % of copper chloride or sulphate. The doses of this mixture ("Kupferlecksalz' which should either be given with the drinking-water, or dissolved and mixed with the food, or in ½—1 litre of water, are as follows:—

(1) For adult cattle over 6 months of age (2) Adult swine	10 gm "Kupferlecksalz" per day per head
(3) Cattle under 6 months old. (4) Sheep (5) Goats	5 gm "Kupferlecksalz" per day per head.

The treatment should last 4-6 weeks and, in order to prevent relapses due to fresh infection it should be repeated twice a week after the animal is cured. This precautions has also the advantage of protecting the animals from contagion when healthy and infected individuals are grazing together, or at times when the disease occurs in an epidemic form.

Treatment by intra-venous or intramuscular injections of a 5 % solution of copper dimethylglycocollate (" Dimethylglykokollkupfer ") has also been resorted to. It is to be recommended for serious cases, or where the state of the sick animals prevents the resorption of the salt by the intestines. Cattle have been given these injections in the following manner :— 10-15 cc. of the 5 % solution were injected twice a week alternately in the muscles of the right and left sides of the croup. Each animal was given 8-10 injections on an average.

II. PROPHYLAXIS. — 1) All animals suffering from coughs and diarrhoea, and coming from infected regions should be isolated.

2) If possible, manure the pastures several times a year with basic slag, or liquid' stable-manure.

3) In cases where infection is to be feared, give " Kupferlecksalz " to all the animals twice a week

518 - **The Clinical Value of the Methylene Blue Reaction and its Use in the Diagnosis of Glanders** (1). — FINZI, G., and CREMONA, P. (Istituto di Patologia e Clinica medica della R Scuola Superiore di Medicina Veterinaria di Torino), in *La Clinica Veterinaria*, Year XLIII, Nos. 17-18, pp. 464-470. Milan. September, 15, and October, 15, 1920.

The author has especially studied, the methylene blue reaction and has compared the chemical results obtained in his veterinary practice with those given by this reagent in the case of human patients. He adopted the technique recommended by RUSSO (*La Riforma medica*, 1905, p. 507) for the preparation of the reagent, and in carrying out his examination. His experiments were made upon the urine of 112 horses, 3 mules, 9 cows, 9 swine and 61 dogs, some of which were diseased in various ways and others healthy, and under different physiological conditions.

The results obtained were as follows :—

The reaction to methylene blue is a very simple test, and the reagent keeps for 3-4 months.

The reaction of the urine has no effect upon the results of the test.

Heating urine to the boiling point does not alter its reaction to methylene blue

In order to be able to interpret the results satisfactorily, the urine should be filtered

Urines with a positive reaction, when no longer fresh (after 2 or 3 days), even if they are filtered, and quite independently of their reaction, lose their power of altering colouring matters to some extent.

When an animal is in good health, the reaction to methylene blue is always negative

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(1) See *R.*, No 399, 1916, Nos. 73, 191, 660 ; 1917, Nos, 51 and 340 ; 1918, Nos. 56 and 175 ; 1919, Nos. 27, 924, 928 ; 1920, No. 70. (*Ed.*)

The injection of mallein and tuberculin into healthy individuals, as well as the administration of drugs, has no effect upon this negative result.

The test is not specific for any given malady, for it is positive in various forms of disease, whether infectious, toxico-infectious, parasitic, or non-parasitic.

The methylene-blue reaction is positive in the case of all horses suffering from glanders; its diagnostic value for glanders is certain when an entirely positive reaction becomes negative, or only slightly positive if 2 or 3 drops of methyl-blue are added, after the mallein diagnostic test has lasted for 10-12 hours.

519 - **The Diagnosis of Dourine** (1). — I. SANI, L. (Istituto di Patologia e Clinica medica dell'Università di Bologna), in *La Clinica veterinaria*, Year XLIII, Nos. 15-16, pp. 393-403, Bibliography of 27 works. Milan, April, 1920. — II. MARCONI, G., and GASPERI, F., *Ibid*, year XLIV, Nos. 1-2. pp. 1-4. Milan, January, 1921. — III. COMINOTTI, D. (Stazione sperimentale per le malattie infettive del bestiame, Milano), *Ibid.*, Year XLIV, No. 4 pp. 81-91., February, 28, 1921.

I. — THE EXPERIMENTAL DIAGNOSIS OF DOURINE. WASSERMANN'S REACTION. — The author used an aqueous extract of heredosyphilitic liver, which was not capable of fixing the complement without a specific amboceptor. The serum examined, which had been taken from the jugular vein, was rendered inactive, and used as soon as obtained. Diluted active rabbit serum (1/1000) was used by the author as a halmolytic amboceptor against the red cells (1/300) taken from a sheep.

As a complement, fresh guinea-pig serum was employed. From the results, the author concludes that:— The serum of a healthy horse, when in contact with a syphilitic antigen, after being rendered inactive, is incapable of fixing alexine. The serum of a horse suffering from dourine behaves in exactly the same manner as that of a healthy horse. This serum has not the property of affecting the complement in the presence of a syphilitic antigen. In the serum of a healthy horse, or of one suffering from dourine, the natural halmolytic amboceptors for the red cells of the horse are either absent, or are present in minimum quantities

II. — THE CO-AGGLUTINATION OF THE BLOOD CORPUSCLES AND THE MACROSCOPIC AGGLUTINATION OF THE TRYPANOSOMES IN THE DIAGNOSIS OF DOURINE. — From an examination of 15 stallions, which were suspected of having contracted dourine, or were suffering from the disease, or had recovered from it, on the one hand, and from his examination of a healthy stallion and mare (controls) on the other, the author arrived at the following conclusions:—

HAEMO-AGGLUTINATION. — 1) *Auto-co-agglutination between microscope slide and cover-glass.* — This experiment gives no grounds for decision, because a more or less positive result was obtained in the case of the blood of all the horses examined.

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(1) See *R.*, Jan. 1916, No. 72; *R*, Jan. 1921, No. 60. (*Ed.*)

2) *Auto-and iso-co-agglutination of the blood corpuscles in a water-glass.* — This experiment, however carefully carried out, and although the necessary controls are employed, can never be decisive, even if it is made at different periods, for the phenomena do not always occur during the course of the illness with the same constancy and regularity.

3) *Auto-and iso-co-agglutination of the blood corpuscles in small noso-sero-reaction tubes.* — The results of this experiment are similar to those obtained from the preceding one, but are more varied, owing to the differences in the dilution of the serum

Macroscopic agglutination of the trypanosomes — This experiment offered solid grounds upon which to base an opinion, because: —

1) Changes in the character of the suspensions of the parasites were clearly seen from the moment of their appearance

2) There is a marked difference in the nature of the suspensions themselves when the serum of infected or healthy horses, respectively, are used

3) The agglutinating power of the serum of diseased horses is regularly very high (it may even reach 1 20 000), whereas that of the serum of healthy horses only occasionally has a partial agglutinating effect with a maximum of 1 200.

4) The reaction is caused by the serum of horses which, during the experiments and even subsequently showed doubtful signs of dourine (return of swelling of the prepuce, orchitis and epididymitis, cutaneous plâques, asymmetrical swellings of the eye-lids, and catarrh of the conjunctiva, multiple alopecic areas).

III. — DEVIATION OF THE COMPLEMENT, SACHS-GEORGI REACTION AND MEINICKE REACTION IN THE DIAGNOSIS OF DOURINE. — As the results obtained by the various investigators, who had employed different methods in the diagnosis of dourine (due to *Trypanosoma equiperdum*) did not agree, the author took up the study of the question, and has arrived at the following conclusions: —

1) In the diagnosis of dourine, the deviation of the complement gives one-sided data, for the result of the test is only taken into consideration when the test itself gives a positive result. But the serum of animals showing all the typical chemical signs of the disease (and even where the parasite had been found in the liquid of the vulvular oedema) gave a negative reaction in a large proportion of the cases investigated by the author. The practical value of the reaction is also diminished by the fact that, when the disease is latent, a positive reaction is rarely obtained. The serum test in question, however, can assist the veterinary surgeon in diagnosing tertiary forms of dourine accompanied by serious symptoms and chiefly affecting the nervous system, or principal respiratory passages, in such a manner as to arouse the suspicion that the case is one of glanders, when no certain or long-standing anamnesic data, or information of an epidemiological character can be obtained. It was with the serums of animals that were late in showing any signs of the disease which had usually attacked the nervous system or chief respiratory passages, that

the autho obtained a large proportion (21.4 %) of positive results coinciding with the clinical and epidemiological history of the patients.

2) The effect of curative treatment upon the anti-complementary power of the serum varies according to the case. In certain animals, it is suppressed by the specific treatment, in others, it remains unaltered. Practically, it is best, however, to take a sample of blood for the serum test before beginning the treatment.

3) The SACHS-GEORGI and the MEINICKE reactions are of no use in the diagnosis of dourine.

520 – The Toxicity of the Extract of the Horse-Bot (*Gastrophilus equi*) (1). —

ZIBORDI, D (R. Scuola Superiore di Medicina Veterinaria di Napoli), in *La Clinica veterinaria*, Year XLIII, Nos. 17-18-19, pp. 470-475, Bibliography of 11 works. Milan, September, 15-30, and October, 15, 1920.

The presence of the larvae of *Gastrophilus equi* in the stomach of horses rarely gives rise to any serious inconvenience. This, however, does not mean that the pathogenetic effect of these maggots is wholly negligible, as is supposed by many persons (2). The author has already proved the toxic nature of the extract of *G. equi* and thereby demonstrated the truth of WEINBERG's researches in particular. In the present work he proposed to find out whether this extract had a more complex action.

The extract was prepared as follows: — 20 larvae, after being repeatedly washed in a sterilised physiological solution, were then pounded up in 20 c.c. of pure sterilised physiological solution. The solution was kept for 24 hours in a refrigerator and afterwards filtered through sterilised gauze. The filtered liquid was injected into the jugular vein in 10 c.c. doses.

The injection caused shivering and the evacuation of much excrement mixed with mucus. The pulse and respiration became more rapid, and much subcutanous oedema of the head was observed. After some hours, these abnormal conditions improved, and a few hours or days later, the animal completely recovered. A postmortem examination made at once or 3 months after the experiments, showed no alterations due to the injection.

The author attempted to discover whether these phenomena were simply a manifestation of a toxic nature, or whether they were due to anaphylactic reaction. He compared the results of his own experiments with those obtained by previous investigators and came to the conclusion that the symptoms produced by the injection of the extract of horse-bot larvae in particular and of that of all parasites in general, is to be attributed to substances which are toxic in the ordinary sense, and are capable of acting in such a manner as to cause the death of the animal, without, however, producing visible anatomical lesions. These poisons may attack the cerebrospinal nervous system by preference and, at the same time, act in a special manner upon the heart, almost like a specific cardiac toxin; further, according to WEIMBERG and SEYDERHELM, they may have a haemolytic effect similar to that of a haematic toxin. (1).

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(1) See *R.*, May 1917, No. 458; *R.*, Jan. 1918 No. 58. (*Ed.*)

(2) Foals out at grass are the animals most frequently attacked and in this case, they show signs of malnutrition, their coat is rough, dark, and devoid of gloss. The mucous membranes are anaemic, the tongue coated, and in certain cases oedema of the legs and lower part of the abdomen is present. The animals are listless, easily tired, and suffer from nervous affections (trismus of the muscles of the jaw, dilation of the pupils and loss of the power of moving the latter). This shows that the disturbances caused by the disease are sometimes so great as to form together with their attendant symptoms a true syndrome. (*Author*)

521 – **A Pathogenetic Bacterium of the *prodigiosum* Type Isolated from the Horse.** — CARPANI, M. (Direttore del Gabinetto Batteriologico Veterinario Militare, Roma), in *La Clinica Veterinaria*, Year XLIII, Nos. 17-18-19, pp. 477-492. Milan, September-October 1920.

Bacterium prodigiosum. Lehmann and Neumann is a micro-organism occurring very frequently in nature; its pathenogenetic characters are usually negligible, and often it is quite innocuous, though it bears a great resemblance to other very virulent forms. The author discovered a new type of the organism in the spleen of a colt that had died at Fara Sabina. He isolated the bacterium, and studied its morphological characters, its reactions to stains, its cultural characters, power of producing disease experimentally, as well as its life-history and antigenic action.

The author proposes the name of *Bacterium erythrogenes equi* for this pathogenic micro-organism which occurs in a red form and in an unpigmented form, both of which, however, are equally virulent.

This bacterium causes serious illness in horses, rabbits and mice; guinea-pigs, rats, and dogs are less affected by it, although they may succumb to its attacks, if it is introduced by inoculation into the serous cavities. It gives rise to symptoms of disease in fowls, which, however, resist experimental infection carried out in all the usual ways.

The action of *Bacterium erythrogenes equi* is more toxic than pathenogenic.

It has many of the general characters of *Bact. prodigiosum.* In its specific characters, however, and especially in its marked pathogenic nature, it resembles: — KOCHS' *Bacillus indicus,* which was isolated from the stomach of a monkey in India: the coccobacillus producing the " mal rouge, " isolated by BROQUET in Cochin-China, where it produces an infectious disease peculiar to the silk-worm moth. It has still greater similarity to SANTORI's erythorobacterium, a micro-organism isolated in Rome from fowls suffering from a form of septicaemia but differs from it in having but a slight pathogenic effect upon the fowls. The similarity existing between these various forms leads to the conclusion that similar bacteria of the chromogenetic group have the power of causing in certain animals, special diseases of a kindred nature, which from the behaviour of the pathogenic agent, as well as from the clinical symptoms and the anatomical and pathological lesions produced, must be classed under the head of haemorrhagic septicaemia. It is thus a mistake to regard the group of chromogeneous bacteria as being composed of ordinary, harmless saprophytes.

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(1) For a similar action of extracts of *Ascaris lumbricoides.* See *R.*, 1919, No. 1166. (*Ed.*)

522 – **Bovine Coccidiosis in British Columbia; Description of the Parasite *Eimeria canadensis*.** — Bruce, E. A. (Animal Pathologist, Department of Agriculture, Agassiz, British Columbia), in *Journal of the American Veterinary Medical Association*, Vol. LVIII, (New Series Vol. II), No. 6, pp. 638-662, pl. 2, Washington, D. C., March 1921.

A dysentry due to coccidia has been observed on range cattle of all ages in different districts of British Columbia. These cases occurred generally in winter and were confined to the dry central part of this Province.

Out of 165 visibly affected animals 50 died (30 %). Young animals suffered the most severely and often the cases were fatal.

Fatal cases engendered death usually in from 2 to days after showing symptoms and within 24 hours of death are subject to fits, death being in convulsions. The principal lesions are confined to the rectum of older animals and to the small intestine of young calves.

The following treatment was found effective in controlling the disease 50 lb., of mixture consisting of sulphur 2 pts., sulphate of iron 2 pts., salt 6 pts., mixed with 100 lb., linseed oil-cake meal, fed in troughs to 100 head per day for 2 weeks.

The coccidium responsible showed several differences from accounts referring to *Eimeria zurni*, and also differed from the coccidia of New Jersey calves reported by Smith and Graybill of the Rockefeller Institute.

It was designated by the name *Eimeria canadensis*.

523 – **The Treatment of Diarrhoeic Enteritis in Calves with Iodide of Starch.** — Darnaud I., in the *Revue Vétérinaire*, Vol. LXXII, 3rd series, Vol. I, pp. 643-746. Toulouse, December 1920.

The author reports the excellent results obtained by the use of iodide of starch in the treatment of calves suffering from diarrhoeic enteritis. The remedy must be administered as soon as it is made.

The method recommended by Dr. Bru (1) is of a very simple nature, but it leads us to hope that great progress may be attained in the prognosis of this disease: — 3 or 4 drops of 10 % tincture of iodine are put into four spoonfuls of gruel; to this is added as much flour as can be taken upon the point of a knife. The medicine is given to the animals five times a day in the intervals between sucking their dams; it should be mixed fresh each time, just before use.

524 – **Treatment of Sheep Scab by Sulphur Dioxide Gas.** — Kretzschmar, in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXIV, No. 40. Hanover, October 1930.

With the revival of sheep-breeding in Germany, sheep scab has again spread rapidly among the flocks. In order to control this parasite in a more efficacious manner, attempts have been made to replace the present methods of treatment, which have proved inadequate, by treatment with sulphur dioxide, which were used with signal success in combating horse-mange during the War (1).

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(1) *Revue Vétérinaire*, Vol. LXXII, 3rd Series, Vol. I, pp. 31-32

The Bavarian Society for te Control of Pests (*Bayerische Gesellschaft für Schädlingsbekämpfung G. m. b. H.*) at Munich, has carried out many experiments on hundreds of sheep, with sulphur dioxide fumes of different degrees of concentration. The results obtained were excellent. This Society has constructed a special apparatus of which 3 photographs are given in the text. It consists of a heavy, closed, wooden box weighing 450 kg. in which 4 sheep can be shut up with their heads only emerging through the opening. An indiarubber collar holds the head of the animals. If the sheep have been shorn, 50 minutes treatment with 4 vol % sulphur dioxide fumes is sufficient, otherwise in order completely to destroy the parasites and their eggs on the parts covered by wool a 4 ½ vol % concentration must be used for the same time.

Cost of use of sulphur dioxide,
based on net price of 209.53 *fr. per* 100 *kg.* (*mark taken at par.*)

length of treatment	Boxes (4 sheep per box)	Numbers of animals treated	Amount of fumes used	Cost of fumes used	Labour
— 50 min	1	4	350 gm	0 74	2 persons
8 hrs. 20 »	1	40	3 500 »	7 35	2 »
8 » 20 »	2	80	7 000 »	14 69	2 »
10 » —	1	48	4 200 »	8 82	2 »
10 » — »	2	96	8 400 »	17 63	2 »
8 » 20 »	4	160	14 000 »	29 38	4 »
10 » 20 »	4	192	16 800 »	35 26	4 »

The author does not advise individual sheep-breeders or even Federations of sheep Breeders to build an establishment where the treatment could be carried out, for owing to the very high cost of installation, and the limited field of action of a stationary plant, they would only find themselves out of pocket.

525 - **Goat Coccidiosis in French West Africa.** — Curasson, G., in the *Recueil de Médecine vétérinaire*, Vol XCVII, No. 6, pp. 129-140. Paris, March 1921.

In the course of a recent stay in French West Africa the author met with intestinal coccidiosis in the goats both in the Sudan and in Senegal.

The cause of the disease which been found in the excreta, and again in the lesions, is *Eimeria Arloingi* The malady is a seasonal one, appearing shortly after the rains have begun, and dies out with the return of the dry season. It mainly affects young animals which usually contract the disease in a very serious form; it is very rare for a kid showing symptoms of diarrhoea and loss of flesh to survive longer than a fortnight. In the course of the experiments carried out by the author at Dakar in 1919 and 1920, 26 goats died out of the 31 taken from different herds. Contrary, however, to what had been observed by VELU (1) in Morocco, many adult animals were found to be suffering from such a severe form of the malady, as to cause considerable loss of flesh; the consistency of the dung was also unusually soft. Two old goats died, and the postmortem examination showed them to be infested with the parasite. The symptoms, however, do not differ in any way from those previously described.

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(1) See *R.*, January 1920, No. 68. (*Ed.*)

The author, however, mentions the frequent occurrence of nervous disturbances which were observed usually the night before the animals died, or on the day of their death. These were not attacks of convulsions preceding the death of the goats such as VELU noticed, but formed a symptomological complex, which was best seen if the recumbent animal was set on its feet. It staggered, its fore and hind legs slid from under it, then it advanced, listless and with its head down describing an arc of a circle of varying radius, when it again fell; on being put on its feet once more, it continued as before.

As remedies, the author has had recourse in vain to emetine, hordenine, the usual intestinal antiseptics and galyl.

The only thing to be done is to try and save the healthy goats by slaughtering the infected ones as soon as the disease reveals itself, and to abandon infected folds and pastures, and avoid damp grazing grounds.

In Senegal, the animals are not allowed to drink at the seianes (2), whch are often used by stock suffering from distomatosis, strongylosis, coccicidiosis, and probably many other parasitic diseases.

526 – The Digestibility Coefficients of the Nitrogenous Matters in the Leaves, Twigs and Small Branches of Trees at Different Periods of Vegetation.

— ENGELS, O. E., in *Die landwirtschaftlichen Versuchsstationen*, Vol. XLVII, Parts V, and VI, pp. 293-355. Berlin, 1921.

The chemical composition and food value of the leaves and twigs of trees have been the subject of much scientific recearch in recent years (3). In many cases, however, the results obtained cannot be compared, because the material had been collected at different times, and the dates of gathering it, a most important factor as regards the results, were not given.

The author used in his experiments a considerable number of trees, the leaves and twigs of which, in his opinion, could be employed as forage He estimated the amount of water, crude fibre, fats, tannin, nitrogenous matter, and nitrogen-free extract they contained.

The leaves and twigs were taken from the same trees at three vegetative periods, viz., in the spring (middle of May) when the leaves had already well developed, in summer (middle of July) during the time of development, and in autumn (middle of October), shortly before leaf-fall.

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(1) See *R.*, July-September 1919, No. 927. (*Ed.*)

(2) Excavations made by the natives in which the water that collects during the rain remains throughout parts of the dry season.

(3) See *R.* Oct. 1918, No 1136 (*Ed*)

The leaves, twigs, and small branches of 12 species of trees (of which the names are given below), were analysed.

The detailed results of the chemical analysis are set forth in the accompanying Table.

(1) Common Alder (*Alnus glutinosa* L.)
(2) Common Hazel (*Corylus Avellana* L.)
(3) Common Oak (*Quercus pedunculata* L.)
(4) Common Beech (*Fagus sylvatica* L.)
(5) False Acacia (*Robinia Pseudacacia* L.)
(6) Lime (*Tilia grandifolia* L.)
(7) Horse Chestnut (*Aesculus Hippocastanum* L.)
(8) Black Poplar (*Populus nigra* L.)
(9) Sallow (*Salix Caprea* L.)
(10) Common Birch (*Betula verrucosa* L.)
(11) Common Ash (*Fraxinus excelsior* L.)
(12) Sycamore (*Acer Pseudoplatanus* L.)

As regards the nitrogenous matter (crude protein) analysis shows that the amount present is largest in spring, and gradually decreases towards summer and autumn.

The digestibility of the nitrogenous substances and true protein is very high in spring. In nearly all the species, the coefficient of digestibility of all the nutritive matters perceptibly decreases with the progressive growth of the trees

The coefficients of digestibility of the nitrogenous matter in the leaves small branches, and twigs of the different trees at various periods of vegetation are given in the appended Table (see page 593).

The largest amount of protein, which is the most important of the nutritive substances, is therefore secured, if the material is collected during the first half of the summer (from May to the end of July). It is true that if it is gathered later, a little more dry matter and a larger yield is obtained, but this delay entails a reduction in the food value.

The best method, according to the author is to chop up and soak the twigs before feeding them (except for sheep and goats.). The soaked twigs can be mixed with other food stuffs, or else a mixture of chopped leaves, twigs, and molasses can be compressed into cakes. ("Laubfutterkuchen"). The cakes are given to heavy draught horses, 5-6 kg. being fed per head per day with good results.

527 - **Coffee Dregs as a Food for Stock; Experiments made in Italy.** — Brentana, D. (Istituto Zootecnico della Scuola Superiore di Medicina Veterinaria di Parma), in *La Riforma Agraria*, Vol. I, No 7, pp 264-268, Parma, July 1920.

The author alludes to the similar experiments made by Aruck (1), and describes his own. He fed finely-ground coffee dregs from the second infusion to horses, draught oxen, and dairy cows.

All animals, however, will not eat them; horses can be given 0.5 kg.,

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(1) See *R.*, Feb. 1919, No. 222. (*Ed.*)

Coefficients of Digestibility of the leaves, small branches, and twigs of various trees.

Date of collection	Leave		Small Branches		Twigs		Leaves		Small Branches		Twigs		Leaves		Small Branches		Twigs	
	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein	Total nitrogenous matter	True protein
	Alnus glutinosa						*Corylus Avellana*						*Quercus pedunculata*					
Middle of May . .	61.1	57.7	18.5	35.5	55.6	48.4	51.3	50.0	37.0	22.2	45.3	38.4	65.9	61.5	30.3	26.6	51.2	37.4
» » July . .	50.0	40.0	10.0	36.3	48.2	39.2	51.7	44.2	37.1	28.4	46.1	38.1	54.6	48.3	30.0	28.7	47.1	42.2
» » October	13.8	38.1	39.1	26.5	40.8	30.9	35.1	34.9	35.0	22.5	35.2	28.0	52.0	48.7	29.4	32.2	43.4	42.2
	Fagus sylvatica						*Robinia Pseudacacia*						*Tilia grandifolia*					
Middle of May . .	57.7	52.7	46.1	33.1	55.6	49.3	56.1	52.1	40.0	30.7	40.0	41.7	72.7	60.0	50.0	34.7	62.8	54.1
» » July . .	54.8	40.0	12.8	30.0	49.0	36.2	50.1	43.9	41.4	34.2	48.7	42.1	52.9	47.4	46.1	33.3	49.6	40.5
» » October	50.0	41.4	36.8	29.1	43.0	35.0	45.4	37.6	39.1	28.0	43.0	31.2	44.4	33.4	33.3	27.3	38.2	30.0
	Aesculus Hippocastanum						*Populus nigra*						*Salix Caprea*					
Middle of May .	50.7	47.9	16.4	13.3	55.7	45.4	50.2	43.0	39.5	30.0	46.0	36.9	51.4	43.9	43.4	33.3	50.0	41.7
» » July . .	49.2	46.6	—	—	—	—	41.6	32.7	36.3	27.2	39.7	30.7	47.4	41.9	40.7	31.8	44.2	37.2
» » October	39.6	31.1	—	—	—	—	37.8	31.3	36.8	26.2	37.3	29.2	41.6	40.4	36.8	28.6	39.5	35.3
	Betula verrucosa						*Fraxinus excelsior*						*Acer Pseudoplatanus*					
Middle of May . .	54.9	50.0	40.0	28.5	52.0	46.0	52.8	49.2	10.7	19.3	51.4	48.6	74.3	74.0	53.4	22.3	70.2	67.4
» » July . .	47.9	15.8	38.2	29.4	12.8	37.3	17.0	15.3	10.0	20.0	16.5	43.4	50.0	50.0	30.1	29.1	49.7	47.9
» » October	43.9	39.4	33.2	26.0	37.9	32.5	42.8	40.6	31.7	25.0	40.5	36.2	43.5	40.0	38.0	25.0	41.9	35.0

of coffee dregs in the place of the same quantity of oats, but very noticeable nervous excitement is thereby produced in the animals.

The cows were of the brown Alpine breed, and yielded 8 to 9 kg. of milk daily. Instead of a ration of 13 kg. of good meadow-hay (consisting for the most part of white clover) + 1 kg. of bran, 13 kg. of coffee dregs + 1 kg. of bran were given to them. The cows at first showed a certain amount of dislike of this new feed, but in the end, they became used to it, and ate as much as 700 gm. per head per day, without experiencing any special effects, the previous slight increase in weight continued, and the milk produced was not altered in any way.

In the case of draught oxen fed on a ration of 15 kg. of good hay + 4 kg. of bran, half of the latter may be replaced by an equal weight of coffee dregs, without the animals suffering the smallest inconvenience.

In short, these experiments confirm the statement that coffee dregs from the second infusion can be used as a stock food.

528 – **Comparative Value of Skim Milk and Whey in Feeding Test.** — See No. 471 of this *Review*.

529 – **The Analysis of the Effects of Consanguinity in the Performance of the Pure-Bred Horse.** — HUTT, F., in the *Fuhlings Landwirtschaftliche Zeitung*, Year LXX, Nos. 3-4, pp. 47-61. Stuttgart, February 1921.

The author touches briefly upon the work of DE CHAPEAUROUGE and his collaborators, RAU, HESSE, GROENEWOLD, SCHMEHL and FRIZEN, whose interpretation of consanguinity was, at the time, readily accepted by German stock breeders. As the question has been treated in a very abstruse manner, it has been summarised in the most important text-books and manuals (1). There are two chief axioms which, as is well known, have been generally believed: —

1) The inbred (intensely bred) animal possesses in a special degree, the qualities of the common ancestry of its parents, and transmits there qualities with unusual certainty.

2) The best degree of consanguinity is in breeding with III-IV *exogamous generations* ("freie Generationen") III-III to V-V ancestral lines ("Ahnen Reihen") respectively.

Ir was only in the last year before the war that a counter-current set in, and the hitherto-accepted interpretation of consanguinity was called in question. The new views are given in a condensed form in the works of OHLY (2) STRUVE (3) STERNFELD (4) and PETERS.

The dominant idea of this opposing theory was as follows: — *Inbreeding, in itself does not affect to any special extent (more than out breeding) the transmission of qualities and prepotency to the inbred animal.*

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(1) WILSDORF, *Tierzuchtung*, Leipzig 1912,; PUSCH-HANSEN *Lehrbuch der allgemeinen Tierzucht*, Stuttgart, 1911,; KRONACHER, *Allgemeine Tierzucht*, Berlin, 1916.

(2) OHLY, *Studien in der Mennofleischherde Munchenlora*. Berlin, 1920.

(3) STRUVE, *Mitteilungen der deutschen landwirtschaftlichen Gesellschaft*, 1911, Part 12.

(4) STERNFELD, *Deutsche Vollblutzucht*, Berlin, 1917.

This theory is strengthened by two new works by PETERS (1) and PEARL (2) respectively, in which the authors try to solve the question of consanguinity in cattle.

PETERS, who bases his remarks upon numerous data relating to cattle breeding in East Prussia, gives several leading ideas as to the qualities of nearly-related animals and their prepotency. Of these the two most important are: —

1) *The desired qualities are not obtained more frequently by inbreeding than by mating unrelated animals possessing the said qualities.*

2) *Healthy, vigorous, inbred animals transmit qualities at least as well as outbred animals, and are perhaps even more prepotent.*

PEARL found, in the course of his researches on the milking capacity of Jersey cows, that the average number of bulls which were the sires of good milch cows were of the same degree of consanguinity as the average number of bulls with female offspring of inferior milk-yielding capacity.

The author himself has undertaken researches on this question, and has taken as his basis the breeding of pure-blood horses at the private Stud Station at Waldfied, for such breeding best seem to fulfil all the conditions under which it is possible to investigate inbreeding and its effect upon performance.

The degree of the consanguinity of each animal was determined from its pedigree. As was to have been foreseen, all the horses were nearly-related. A small number of stallions, mentioned in the text, figures in almost all the pedigrees as the common ancestors upon which the inbreeding was based. Since these stallions began service, 5-7 generations of horses have been bred; reckoning 10 years for each generation, most of the cases of consanguinity will give 5-7 exogamous generations.

Table I gives the division of the animals according to the different degree of consanguinity.

TABLE I.

Exogamous generations	0	1	2	3	4	5	6	7	8	9	10	11	12
Number of horses belonging to each degree of consanguinity		1	20	34	49	60	6[illegible]	49	5[illegible]	80	4	0	3

With a view to studying the capacity of the animals both for breeding and for racing purposes they were divided into two groups: —

(A) *Brood mares* (judged for their breeding qualities).

(B) *Stallions and mares* (judged for their racing qualities).

(A) *Brood mares.* — This group consisted, neglecting unfertilised and young mares, of 52 animals. In order to judge of their breeding qualities, the author adopted the system of estimating the value of their progeny by their success as race-horses. The total of the performance figures divided by the number of the offspring gave the reproductive value of the brood-mares.

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(1) PETERS, *Vererbungsstudien auf dem Gebiete der Rinderzucht*, Berlin, 1920.

(2) PEARL, A Contribution of Genetics to the Practical Breeding of Dairy Cattle, *Proc Nat. Academy of Sciences*, U. S. A. 1920.

(B) *Stallions and mares.* — This group (after subtracting colts that had died, and animals, whose performance could not be judged on account of their youth) contained 257 animals.

As a criterion of their capacity, the author took the money prizes the horses had won in the various races in which they had taken part.

The money prizes reckoned by the author are the average sums awarded annually at the 22 races marked "important" in the German Racing Calendar.

The total number of horses bred at the Waldfried Stud Station was divided into 6 classes according to their racing powers (these classes are given in Table II.

TABLE II. — *Horses classed according to their racing capacity.*

Classes	Money prizes
1.	123 460.00 francs (*mark* at par) and over
2	61 730.00 — 123 460.00 fr.
3	12 346.00 — 61 730.00 »
4	3 703.80 — 12 346 00 »
5.	1 234.60 — 3 703.80 » (and horses taking part in hurdle races)
6.	did not enter for the races

TABLE III. — *Mares and Stallions Classed according to their Racing Powers.*

Exogamous generations (degree of consanguinity)	Classed according to their Racing Powers											
	1		2		3		4		5		6	
	No. of horses in different degrees of consanguinity	Percentage of total horses of same degree of consanguinity (classes 1, 2, 3, 4, 5 and 6)	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
0	—	—	—	—	—	—	—	—	1	100%	—	—
1	—	—	1	6%	2	13%	4	25%	5	31	4	25%
2	3	9%	2	6	9	28	1	3	7	22	10	32
3	—	—	4	14	15	52	1	3	6	21	3	10
4	3	6	9	19	20	43	7	15	7	15	1	2
5	5	10	6	12	9	18	6	12	11	22	13	26
6	1	3	5	13	14	36	4	10	9	23	6	15
7	1	3	2	7	6	21	11	38	6	21	3	10
8	1	13	—	—	2	25	1	13	2	25	2	25
9	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	1	33	—	—	1	33	1	33	—	—
11	—	—	—	—	—	—	—	—	—	—	—	—
12	—	—	1	33	—	—	—	—	2	67	—	—

TABLE III *a* (Table III reduced)

Exogamous generations	Horses classed according to their racing powers		
	1 and 2	*3 and 4*	*5 and 6*
	per cent	per cent	per cent
0 – 2	12	33	55
3 – 5	21	46	33
6 – 8	14	48	38

TABLE IV. — *Brood mares.*

ations degrees of consanguinity)	Animals classed according to racing powers											
		1	2		3		4					
	Numbers of horses in the different degrees of consanguinity	Percent. of total number of horses of same degree of consanguinity (classes 1, 2, 3, 4, 5 and 6)	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
2	—	—	—	—	—	—	—	—	1	100%	—	—
3	—	—	1	9%	1	9%	7	64%	2	18	—	—
4	—	—	—	—	2	20	7	70	1	10	—	—
5	1	7	2	14	6	43	1	7	3	22	1	7
6	—	—	1	9	3	27	5	46	2	18	—	—
7	—	—	—	—	2	50	1	25	1	25	—	—
8	—	—										
9	—	—										

The examination of these Tables shows that in the cases of an average and slight degree of consanguinity, the animals capacity is equal, whereas close consanguinity diminishes their racing powers. The Table for the brood mares also shows no relation between performance and the degree of consanguinity. Hence the author is of opinion that inbreeding had no effect upon the racing or breeding performance of the pure-blood horse, and that intense inbreeding had injurious effects.

How far it is permissible to generalise from these results must, however, be shown by further experiments.

530 – **Inheritance of Milk and Meat Production in Cattle.** — See No. 471 of this *Review*.

531 – **Influence of Rations on Reproduction in Cattle.** — See No 537 of this *Review*.

532 - Report on Live Stock Breeding in the Northern Territories of the Gold Coast. — BEAL, W. P. B. (Report from the Colonial Office, London), in *Tropical Veterinary Bulletin*, Vol. 9, No 1, pp. 36-50. London, Feb. 1921

As compared with other great stock-raising countries situated outside the tropical zone, the region under consideration cannot be said to be an ideal one, but, under certain conditions, it is more fortunately situated, for example, than Australia. In no district of the Northern Territories is there a genuine water famine ; water can usually be obtained by travelling a short distance. Horse sickness East coast fever in cattle cause ravages in the southern portion of the African continent, but in the Northern Territories have not yet been encountered. The country, however, has suffered from severe epizootics, the principal one being the outbreak of contagious bovine pleuropneumonia in 1912-1913, and rinderpest in 1916-1917, but these outbreaks are, however, not considered to have been so virulent as those experienced elsewhere. The author proceeds to describe the distribution and administration of the different areas with their provinces and districts, and also the physical conditions prevailing.

The White Volta is the chief river of the Protectorate, and this and the other rivers contain water throughout the year.

The climatic conditions of the Northern Territories show a relatively high solar maximum point but a mean of 77°, two seasons; 3 months of heavy rain, 3 months of showers and 6 months of dry weather.

I. ORIGIN OF THE PRESENT-DAY LIVE STOCK AND METHODS FOR REARING. — Cattle, sheep, goats, horses and donkeys are believed to be of recent introduction. — The only tribes which raise livestock are the Peuhlish people, and the descendants of Peuhlish marriages and the Peuhlish themselves are immigrants from foreign parts. These people and their descendants certainly introduced the zebu ox, the present day breeds of sheep and goats, the horse and donkey, but the Taurine type of cattle found in the Territories is believed to be of different origin.

The methods of rearing as practised by the natives are crude and unsatisfactory. There is no division of the herds or flocks, no provision is made for the foraging of stock during the dry season, the animals have to depend entirely on the grazing obtainable and the only care taken is to supply them with water, often very inferior. Dietetics, selection, and other hygienic principles are unknown.

II. GRAZING AND FEEDING. — The grazing lands are unfenced and are the common property of the peoples, irrespective of whether they are the indigenous races or immigrants importing and driving cattle to Ashanti and the Gold Coast Colony.

During the rainy season and up to the end of November, there is no scarcity of grazing and it is good and abundant. After this time, the ground becomes dried, all the grasses become dry and brittle, except in pastures in the vicinity of rivers and swamps. The country now begins to be " fired " and gradually becomes a black waste. As regards the chemical composition of the soil, in the low lying countries there is a deficiency of carbohydrates and phosphates In the northern zone the cattle are distinctly larger than those of the southern zone, and their size is believed to be due to the greater quantity of carbonates and phosphates in their fodder. The grasses hitherto identified comprise the following: — *Cenchrus catharticus* Del.; *Digitaria horizontalis* Willd; *Eleusine indica* Gaerth; *Eragrostis ciliaris* Link; *Pennisetum purpureum* Schum. (These were identified by CHIPP (late assistant Conservator of Forests, Gold Coast). The following were identified at Kew: — *Cymbopogon rufus, Eragrostis aspera, E. tremule* (*Iryza sylvestris*).

The seeds of 19 other species were collected and remain to be identified.

III. STOCK BREEDING. — (1) *Cattle.* — The breed of cattle in the Territories is the humpless (taurine) type A few of the humped (zebu) breed occur and are usually confined to the division bordering on the northern frontier of the Protectorate. Crosses between these two breeds are fairly numerous, especially towards the northern frontier. The origin of the taurine type, which is identical with that found indigenous to Dahomey and French Guinea is a debatable subject PECAUD considers that the type is indigenous to Central and West Africa; CARDEMOY and WELLAERT state that it is of Asiatic origin. COSSAR EWART has examined the skulls of this breed and believes it is of Celtic short horn origin. The author agrees that there is a great similarity between this breed and the British-shorthorn, although the west African breed is degenerate, due to interbreeding and climatic conditions.

The cattle are small, symmetrical, compact animals very much like a miniature shorthorn. They are slow to mature and reach their full size at the age of 6 to 8 years Bulls and bullocks, when allowed to reach their full development, turn out to be very fine animals, and for their size would be able to compete against some of the European small fancy breeds, such as Dexter-Keny cattle Heifers become sexually mature at from 18 months to 2 years old, bull calves at 15 months. Calves as soon as they can graze *i. e.* at about 3 months old, are muzzled with spikes in certain districts to prevent them from sucking, and the mother thus dries off and comes into season again, so as to produce calves yearly. It the cow is left to herself, she will give milk from 6 to 9 months and comes into season from 6 to 12 months after calving. A good milking cow gives on an average about 2 pints of milk a day.

The averages of the various body measurements of these animals in the different districts are given as follows: Average age 7 years; length of body to shoulder 46 in., to muzzle 65 ½ in., girth behind shoulder 54 ½ in., in front of back 55 $^3/_4$ in., length of forearm 11 in., length of thigh 14 $^3/_4$ in., bone below knee 6 $^3/_4$ in., below hock 7 in., head length 16 ¼ in., breadth 7 ¼ in., width across loins 13 $^3/_4$ in.

The chief colours are black, and black and white. Brindles are common and when seen are grey. Red and white, and yellow and white also occur.

The shape of the horn varies from right angle projections to those that curve downwards, forwards and backwards into lyre shape. The feet are usually black, but should white be very predominant, the feet are white or white and black. The breed is a hardy disease-resisting animal and a very good feeder and forager. The meat, although of good quality and taste, lacks marbling. In the hilly regions and on stony ground it runs into a bigger animal; in the north along the frontier it is probably mixed with zebu blood, but has lost the characters of that breed. The chief faults in connection with the breeding of these cattle are : interbreeding, commencement of breeding at too early an age, starvation of calves, improper feeding of cows during lactation, no regulation of calving time, abundance of ticks on cows, and the infection of cattle with disease while they are young especially blood diseases.

B) *Sheep*.—The only breed found in the Northern territory is probably descended from the Karakul breed of sheep in Asia, but has lost its characteristics through climatic conditions also by prolonged inter-breeding.

Small wire-haired, sheep are produced colourp ure white, or white and black, or an admixture of white and black. No mixtures of red and white or yellow and white are seen as occurs in the Fulan or Lagos breed of sheep. The males are furnished with good regular-curved horns have a crest of hair on their neck, and a long beard of hair running from the jaws to the breast. The ewes sometimes possess a straight stump of horn and have a good and well-shaped udder. The newly-born lamb exhibits the peculiar curl of its hair which is characteristic of the Karakul breed. This curl is lost soon after birth, and a month afterwards the hair is entirely straightened out. The fault of the breed lies in its small size and lack of taste. Considering the fact that sheep-breeding is a profitable industry for the Territories, the introduction of foreign blood is advised in order to improve the nature breed, *e. g.* the Karakul and Merino breeds, and a start might be made with Merinos and Dorsets; the fleece would be a drawback in a hot climate, but they could be kept in the open, country and not in the forest country where the climate is hot and damp.

C) *Coats* — Probably of Asiatic origin. Very small misshapen, animals due to many generations of inter-breeding; general colour brown usual caprine style of horns; females frequently of bad shape but they possess good udders and give plenty of milk to their young. The breed is fast degenerating and the introduction of the Angora breed of goat is recommended for improvement pusposes.

D) *Horses* — Probably introduced by the Peuhls. From the shape of the head and ears, the horse is probably of Arab origin. The colours are chiefly bays, then blacks, chestnuts and roans. As a rule they are wanting in bone and good hind quarters; they run up to 14 hands high, but 13. 2 1/2 hands is the average size. Very few stallions are castrated; the mares are degenerating and no selection for service by good stallions is practised.

Horses are, however, better cared for than other domestic stock. They are given an extra diet of groundnut hay, and pea and pea hay during the dry season when grass is scarce, and if used for riding they are given guinea corn (*Sorghum vulgare*) or millet.

Measurements of stallions in different districts varying in age from

7 to 14 years are given as follows: height 13 to 13.3 hands, bone 6 ¼ to 8 in., girth 62 ½ to 68 in. The horse bred is therefore small in spite of the fact there is no inter-breeding. This is attributed to two reasons: (1) Absence of selection of sire and (2) deficient dietetics.

If the stallions are to be improved for draught purposes the author considers that one of the small heavy breeds such as the French Percheron should be introduced.

E) *Donkeys.* — Also of recent introduction. Donkey breeding is on the increase. The animals are fair sized compared with other livestock, hardy and willing to work, light in colour with the characteristic spinal stripe and frequently with shoulder and leg stripes. Average height 12 to 12.2 hands. The female possesses a good udder and gives a good deal of milk to her young. Feeding is very similar to that of horses, no selection is made for service, but very little inter-breeding goes on as donkey breeders are continually purchasing new animals or exchanging donkeys for cattle and sheep. Donkeys are used as pack and riding animals.

F) *Pigs.* — Very few pigs are bred in the Territories. The chief pig breeding part is in the Kacomba country, Yendi District. The animal is probably descended from the wild wart hog, (*Phacochoerus*), frequently seen in all the swampy areas. The animals are small and black. The sows farrow easily and have large litters, often 11 or 12 in the litter.

G) *Poultry.* — Fowls, ducks, turkeys, pigeons, guinea fowls, and ostriches are all bred in the country. The native fowl is described as a small hardy bird, of almost every colour, with game features predominant. According to the author they can be readily improved and the best cross would be with game and Orpington birds.

IV. INCREASE AND DECREASE OF LIVE STOCK. — The losses are at present very serious, and amount at least to 35 %, made up of 22 % attacked by disease.

V. ENTOMOLOGICAL SITUATION AND THE MORE IMPORTANT EPIZOOTIC DISEASES OF LIVE STOCK. — The entomological situation is discussed and its relation to the livestock industry, and a detailed description is given of the epizootic diseases.

The author observed during tour of inspection 3 species of tsetse fly, viz. *Glossina morsitans*, *G. tachinoides* and *G. palpalis*, but these are limited to the river banks.

The more important epizootic diseases include: anthrax, contagious bovine pleuro-peneumonia, contagious foot-rot, epizootic lymphangitis, filariasis, fowl cholera, piroplasmosis, rinderpest, haemorrhagic septicaemia, and trypanosomiasis. Filarial infection is transmitted by some species of *Culex*. The most frequently found piroplasms of cattle in the Northern Territories are: *Piroplasma bigeminum*, *Theileria mutans*, and a third piroplasm, which is occasionaly met with and which has been identified provisionally by MACFIE as a species belonging to the genus *Achromaticus*. These parasites set up merely benign affections, seeing that all calves become infected shortly after birth.

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T. parva, the cause of East coast fever of cattle has not, according to the author, been discovered in the country, in spite of frequent search, A tick which is capable of producing its spread, viz. *Rhipicephalus simus*. exists and would represent a serious factor if the disease should ever be introduced.

The horse is also said to be subject to infection with *Nuttallia equi*. which produces a dangerous anemia frequently terminating in death, Up to the present time piroplasmosis has not been detected in sheep.

Three types of trypanosomiasis are known to occur in the Northern territories viz. *T. brucei* (*pecaudi*), *T. vivax* (*cazalboui*) and *T. congolense*. The symptoms caused by all 3 species are very nearly the same in horses ; but infection caused by *T. vivax*, however, is not so severe as that caused by *T. brucei*.

Atoxyl is considered to be undoubtedly the best drug to use for treatment, combined with good nursing and feeding, in cases that are not too far advanced. In cattle, *T. vivax* does not appear to cause much harm and no symptoms were observed ; *T. brucei* is said to cause a sudden emaciation, which becomes chronic and lasts for a year, after which the cattle gain some degree of tolerance towards the infection and commence to put on flesh again.

T. congolense was first discovered by the author in the country in 1912 and hitherto had only been found naturally in horses, in which all the chief symptoms of trypanosomiasis were seen. By experimental inoculation it was found very fatal to sheep, goats and dogs.

VI. CATTLE TRADE. — This trade appears to be small and many more cattle could be exported if the herds were increased. It is estimated roughly that the trade in indigenous cattle for the year 1919 could be represented at 2000 head.

VII. ESTIMATED LIVESTOCK CENSUS AND VALUATION IN THE NORTHERN TERRITORIES AND YENDI DISTRICTS

	Heads	Total Value	Average price per heed	
		£	£	s.
Cattle	68 500	548 000	8	
Sheep and goats	150 000	75 000	—	10
Horses	1 097	10 970	10	
Donkeys	2 003	10 015	5	
Pigs	321	963	3	

533 - **Private Stud Stations Versus State Stud Stations.** — I. MOMMSEN, in the *Deutsche Landwirtschaftliche Tierzucht*, year XXIV, No. 47, pp. 485-487. Hanover, November, 1920 — II. DE MONICAULT, P., in the *Journal d'Agriculture pratique*, year 85 New Series, No. [illegible]p. 169-170. Paris, March, 1921.

Before the war, it was in the interest of the State to provide good remounts, and no expense was spared in order to be able to supply horse-breeders with first-rate sires (whole-blood, or half-blood), the service-fee being always very moderate. On the other hand, the State has never cared, and does not care to-day, to take measures for the improvement of carriage, or cart-horses, and any progress that has been made in this direction is entirely due to private initiative. In this branch of horse-breeding the participation of the State hinders all work of improving the breed, for the competition of the Government, which provides inferior stallions at very low service-fees, prevents, or at least hinders, the work of any really good, private Stud Station.

The author shows the inferiority of the State Stallions by the following figures: —

Show-Sale by auction of horses in the Province of Saxony. — Of the 65 stallions competing at the show in 1916, 23 were the offspring of privately owned sires; there were no colts by State Stallions.

Of the 77 stallions competing at the 1917 show, 18 were by private sires, 1 by a State sire.

Of the 88 stallions competing at the 1918 show, 22 were by private sires, 1 by a State sire.

Of the 36 stallions offered for sale in 1918, 2 only were by State sires.

Of the 33 stallions offered for sale in 1919, 3 were by State sires.

Of the 98 stallions entered in 1916, 22 were by private sires and 4 by State sires.

On the 105 stallions entered in 1917, 27 were by private sires and 3 by State sires.

Of the 123 stallions entered in 1918 (1), 27 were by private sires, and 4 by State sires.

During the years in question 150 State sires, and 100 privately-owned Belgian sires were placed at the disposal of breeders.

The author brings out the fact that at a time when the State has very limited means at its disposal for the encouragement of horse-breeding, it still wishes to saddle itself with the heavy expense of keeping up Government Stud Stations.

He insists upon the necessity of giving up National Stud Stations into the hands of breeders, which in his opinion can best be effected by selling the existing establishments, at moderate prices, either to the Provinces, or the Chambers of Agriculture. As soon as they have changed hands, the Stud Stations should be re-organised upon a paying footing, so that the large grants hitherto made to them may be used for the encouragement of private stallion-keeping, which would soon revive.

II. — The breeders of half-blood animals having asked for a draught-horse stallion, a request which cannot be satisfactorily or immediately granted, the author has attempted to suggest a solution of the problem.

The inpossibility of further increasing the Stud Stock by at least 400 horses, owing to lack of credit, premises and stable-hands, means a decrease in the number of privately-owned stallions.

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(1) The other stallions came originally from Belgium and the Rhine Provinces.

According to the author, the problem to be solved is how to receive the private Stud industry, which has tended to disappear owing to the following reasons: —

1) The service-fee cannot be raised by private stallion-owners in proportion to the increase in the general stud expenses, and to the sale price of mares and even of horses, because the Government, which always has a Stud Station in the neighbourhood, keeps the service fee too low, and becomes a formidable competitor.

2) The premiums granted to stallion-owners have been raised but little since the war, and are insufficient to compensate for the increased expenses of the private Stations.

3) Stallion-owners, not having been able to keep their stock during the war, have been disinclined to make the necessary effort to reconstruct their stables now that the war is over (there being an enormous difference between the prices the animals fetched in 1915, and the purchasing prices in 1919 or 1920)

Instead of requiring the State Stud Stations to increase their already large stock by the addition of 400 new animals, which would entail an annual out-lay of 4 000 000 fr, the author thinks it would be better to raise the grants made to private stallion-owners, and to assist them in the purchase of sires

Such measures, if carried out without loss of time, would allow of the rapid reconstruction of private Stud Stations.

534 - **Comparative Values of Barley and Oats for Work Horses.** — See No 471 of this *Review.*

535 - **The Testing of Milk Production from the Stock-Breeding Standpoint.** — I. VOLTZ W., Zur Kritik- der Milchviehkontrolle, in the *Mitteilungen der Deutschen Landwirtschaftsgesellschaft,* year 36, No 9, pp 151-154, Berlin, February, 1921, — II SCHMID, A Recherches sur le rendement en lait de vaches de la race Simmenthal in *Annuaire agricole de la Suisse*, year 21, No 1, p 17, Lucerne, 1920 — III BRUNO (General-Inspector of Agronomic Stations), L'urgence du contrôle laitier in *La Vie agricole et rurale,* year 9, Vol XVII, No 45, p. 273. Paris, November, 1920. — IV. ABL (Tierzucht inspecktor . Erfurt) Ein Vorschlag zur zuchterischen Auswertung der Leistungs kontrolle in the *Deutsche Landwirtschaftliche Tierzucht*, year 24 No. 34. pp. 347-348. Hanover, August, 1920. — V. GUTH (Bezirkstierarzt, Amberg), Ueber Milchleistung und Milchleistungsprüfungen, *Ibid.*, year 24, No. 21, pp.217-219. Hanover, 1920. — VI. DRIEHAUS (Tierzuchtdirecktor Uelzen), Die Pramierung nach Leistungen an Hand praktischer Beispiele, *Ibid.*, year 24, No. 42, pp 431-433. — VII HULSEBEK (Bezirkstierzuchtinspeckor, Wittenberg), Leistungs pramierung der Rinder, *Ibid*, pp 433-434. — VIII WHITE A. H., (Senior Superior, Cow-Testing) Cow Testing work, in *The Agricultural Gazette of Canada*, Vol 7, No. 4, p 313 Ottawa, April, 1920 — IX ERDHAN, H. E., Organisations among Ohio Farmers, in the *Ohio Agricultural Experiment Station, Bulletin*, 342, pp 117-166, Wooster, Ohio, June. 1920

AN ACCOUNT OF THE TESTING OF MILCH COWS. — Denmark was the first country to form milk Cow Testing Associations These are closely connected with the co-operative movement, which is greatly developed there, and is the cause of the extraordinary progress of the export trade in animal food-products. Before these Associations were established, it was, however, necessary to make many and definitive experiments in the feeding of dairy cows, in order to discover the relations between food and milk production.

The first Testing Association was founded in Denmark in 1895 and in Germany in 1897 (1). Since that date they have extended over Europe and in other parts of the world. The object of these Associations is to furnish the agriculturist with technical information as to feeding and rearing his stock, and especially to teach him how to determine the *relative yield* of dairy cows, the *cost of feeding them*, the amount of food necessary for obtaining milk of the same weight or fat content (other conditions being equal), and by these means to enable the breeder to select the most thrifty animals which can also be used for breeding purposes (2).

The relative milk yield is usually determined by taking 3 factors as a basis *i. e.*, the price of food, the " nutritive units, " and KELLNER's starch equivalents. The author shows briefty that the first two factors are erroneous, and discusses the value of the third

As is well-known, KELLNER maintains that the starch equivalents give a sufficiently exact method of determining the utilisation of the food, even from the points of view of milk production. The author, however, does not agree with him, and very justly remarks that KELLNER has not allowed for the specific action of different foods upon the milk yield and demonstrates the troubles due to this fact by the help of experiments. The total effect of a ration upon milk production depends upon the feed in its entirety, and not upon its starch equivalents.

Nevertheless, in spite of the inadequacy of the starch equivalents system from the dairy-farmers' point of view, the author is obliged to adopt it in default of a better, but he shows the importance of directly measuring the effect of the most important foods upon milk production, by means of systematic experiments carried out on a large scale, and with the object of obtaining a basis for the compilation of better forage-tables for milch cows than those existing at present.

There are, however, many other difficulties connected with experiments relating to milk production. The milk tests and the estimation of the food consumed are generally made but twice a month, and are inaccurate, seeing the impossibility of directly determining the amount of food eaten in the meadow. Only approximate results can be obtained. Since the milk yield varies at the different lactation periods, the author advises that breeding-cows be discarded only if they have given bad results in 2, or better, 3 successive periods of lactation.

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(1) On May 1, 1914 Germany boasted of 792 Testing Associations, with 13 219 members. The number of cows tested was 351 857 Cf. HAUSEN, H., *Die Milchviehkontrolle in der Rindviehzucht des Deutschen Reiches*, Berlin, Parey, 1916, p 20.

(2) See, G. PUSCH, *Die Beurteilung des Rindes.* Berlin, Parey, 1910, p. 321. (*Ed.*)

Another circumstance which renders uncertain the testing of relative capacity is the fact that "individual feeding" is but little practised (1).

The author is of opinion that it is unwise to insist on judging a cow's milk-yielding capacity solely from tests, as is at present the custom, and he is no advocate of entering the results of relative milk-yield tests in the Herd book. If a milk-production competition is part of the Show programme, other necessary qualities must not be lost sight of in awarding the prizes, viz., 1) the absolute milk yield (which should increase *pari passu* with the relative yield); 2) the health of the animals; 3) their symmetry; 4) their pedigree.

Nevertheless, it cannot be denied, that the testing of dairy cows has yielded excellent results. It has even contributed to an increase in the average milk production of farms (2). These results obtained by the testing Associations must be attributed in the main to the diffusion of practical instruction, both in the feeding and rearing of cattle.

The author is frankly averse to the determination of the relative yield, and he concludes by stating, that the testing staff should be equipped with more specialised and thorough scientific knowledge, in order to be in a position to impart useful information to the breeders as regards the feeding and selection of their stock. He also says that they should be adequately paid.

II. — RESEARCHES ON THE MILK PRODUCTION OF SIMMENTHAL COW. — SCHMID states that in order better to judge of the quality of these animals, the milk-testing trials at Agricultural Shows should be more numerous. The Central Administration of the Liebefeld Station devotes special attention to milk control with a view to rendering it more general in Switzerland.

KAPPELI has even taken the trouble to collect the data of the milk production tests made from 1899 to 1914 in the Liebefeld cow-sheds, and he thinks that a test made twice a month (using a sample of the morning and evening milking) would be enough for the determination, in a sufficiently accurate manner, of the milk yield during each period of lactation and also of the quantity of milk given by each cow (3).

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(1) Cf. O. KELLNER, *Die Ernährung der Landwirtschaftlichen Nutztiere*. Berlin 1916, p. 511. (*Ed.*)

(2) On the transmission of the qualitative and quantitative milk yield, See H. WERNER, *Die Rinderzucht*, Berlin, Parey, 1912, p. 506, and *R.*, Feb. 1920, No. 230. — M. COQUIDE, in a recent publication (*Améliorations des plantes cultivées et du bétail*, 607 pp., numerous figures; Paris, Baillière et fils, Encyclopédie agricole, 1920), without denying the importance of increasing milk production by the direct means of selection, also states that it is difficult, to estimate it practically, but he does not think that the importance of correlative characters is lessened.

NILS HANSSON has written a work dealing with milk-testing in Scandinavia entitled *Kontrollforeningarnes arbetsfält*. E Jansson, Malmo. — See also *R.*, Feb., 1921, No. 177.

For results obtained in Denmark, See *The Agricultural Gazette*, 1920, No. 2. (*Ed.*).

(3) See Landwirtschaftliches Jahrbuch der Schweiz 1915, No. 22. (*Ed.*)

Since 1919, the results of these milk trials have been entered in the Liebefeld Herd book.

III. — THE NEED FOR TESTING MILK PRODUCTION IN FRANCE. — BRUNO thinks that rigorous individual testing of milk production and butter yield should be instituted in the liberated regions of France, where there are now large numbers of cattle of different origins. The author suggested the founding of Testing Associations ; special attention being paid to the fat content which should be estimated according to GERBER and FONARD's methods.

IV. — SUGGESTION AS TO THE USE OF TESTING THE MILK SUPPLY FROM A STOCK-BREEDING POINT OF VIEW, IN GERMANY. — ABL regrets that the war has so greatly decreased the importance of the Testing Associations which were formerly in a most flourishing condition, and considers that it is now more than ever necessary to use every means to restore them to their previous influential position. The stock breeding principle lying at the base of testing, and which has hitherto been regarded as all that is needed for rearing selected animals, should be applied to the mass of the cattle.

The author inclines towards compulsory testing, but he fears that the Unions, if left to themselves, would proceed to extremes, and only aim at great individual milk production, which if carried to undue lengths, would be detrimental to the health and vigour of the race. It is clear that testing should also be extended to the mountain races, but hitherto all the data as to milk yield have remained in the hands of the breeders. PETERS is well aware of the importance of these data, which would form a useful basis for estimation

The author has devised a new scale of points which he suggests should be used in judging dairy cows at shows. He divides the animals into different classes according to their absolute milk and fat yield relatively to 100 starch equivalents. The marking for absolute yield, in proportioh to the annual milk production, is limited to the " recognised healthy optimum, " which may vary with the breeds and localities, after which the number of points decreases with the further increase of the absolute yield. On the other hand, the points for the relative yield, which is expressed here by the fat content of the milk, increase in a continual and regular manner from the minimum of 1 point for the yield of 2.5 to 5 kg., of fatty matter per 100 starch equivalents, to the maximum of 7 points for 9.1-9.5 kg. of fat per 100 starch equivalents.

These points, which mark both yields, should be settled each year by the control staff, and ought to be an indispensable condition of the registration of the cattle in the Herd-books. The system adopted by breeders of the Simmenthal and Glan breeds, and to some extent by those rearing Francken cattle during the last decades, shows the danger to which the health and vigour of these animals is exposed, and gives occasion to fear, that the objects aimed at in breeding these valuable races will thereby be defeated.

V. — MILK YIELD AND THE METHODS OF DETERMINING IT. —

GUTH points out that hitherto the absolute yield of milk and fatty matter is tested in Bavaria (this test is called the *examen*) whereas in North Germany the relative return is determined (*contrôle*). In the latter region, however, a large number of concentrated commercial foods are used, and in the *contrôle*, no importance is attributed to the basal bulky fodder. In Bavaria, on the other hand, these concentrated foods are little employed, and it is still necessary to take the farm fodder into account and to continue to determine the absolute return. (*examen*).

PROBST, also thinks, that the *contrôle* of the relative production should afford the breeder some assistance in judging of the absolute production.

VI. — PRIZES AWARDED FOR YIELD BASED ON ACTUAL PERFORMANCE IN GERMANY. — DRIEHAUS recalls the fact that in nearly all the districts where the plain breed of Pied Black Cattle were kept, experiments were made before the war on the basis of the absolute yield of milk and butter fat. In some cases, a system of awarding the prizes was adopted which combined both methods, with the idea of putting the relative fat content of the milk before the total yield of fatty matter. Some districts even reckoned the parents to the credit of the animal and thus placed selection according to milk yield upon a solid basis.

At the Lüneberg show, there were 10 classes for cows and 1 for bulls. In order to be admitted into the latter class, it had to be shown that the dam of the competing bull had yielded 110 kg. of milk fat during the 1st lactation period, 130 in the 2nd, and 150 in the 3rd. The classification of the cows began with yields of 110-120 kg. of fat during the 1st lactation, period, up to 170 kgs., and over during the subsequent periods Further, the testing had to last 1, 2, or 3 years. Thus the first class consisted of cows that had been tested for 3 years at least, and had given from 150-170 kg. of fatty matter per annum ; whereas the 10th class was made up of cows that had only been tested for one year, and had supplied from 100 to 120 kg. of butter fat during their first lactation period.

Although this system is not without its defects, it has the advantage, according to the author, of making symmetry and milk yield correlative characters.

There then follows a criticism of the suggestion made recently by the German Society of Agriculture to the effect that, in future, the average yield of the competing animals or groups of animals, should be taken into account in awarding prizes, to the exclusion of the individual characters of the cattle. This proposal had already been criticised by HANSEN and other authors.

VII. — THE AWARDING OF PRIZES FOR MILK YIELD IN GERMANY. — HULSEBECK congratulates the German Society of Agriculture on having acceded to the wishes of intelligent cattle-breeders who desired that the animals should not be judged merely by their exterior, but that the actual milk yield should also be taken into consideration.

The first time that prizes were adjudged for milk production was in 1913 at the Show held at Wittenberg, on which occasion KOFAHL decided that the judges were not only to take into account the symmetry of the animals exhibited, but also their actual milk yield, and that of their ancestors to the 2nd generation, in the case of cows, and to the 3rd in that of bulls. The author gives the number of points credited for each of these characters.

While agreeing with the censures passed upon the award of prizes according to the average of the farms, the author considers it most encouraging that the system of rewarding the highest milk yield should have been officially recognised by the German Society of Agriculture, which will doubtless, as Hansen has already said, not fail to improve this system after the results of the approaching shows have proved its value.

VIII. — Cow-Testing in Canada — Nothing is more useful than to increase the milk yield of a cow, but this can only be done when the breeder knows the exact amount already given by the animal. The Dairy Branch of Canada has interested itself in this question since 1904, and has published regulations on the subject since the spring of 1918. In each province, with the exception of British Columbia, the Dairy Branch has placed a competent officer to whom has been entrusted the task of organising Dairy-Cows Testing Associations.

In 1919, there were in Canada already 22 517 cows under the supervision of the Branch, of which 10 374 were in Quebec Further, thousands of test-forms were asked for by unorganised breeders, who were evidently engaged in selection work on their own account.

White estimates that the effect of the work of the Dairy Branch has been to increase individual production by 30 %.

The object of testing the cows is to be able to obtain qualitative and quantitative data respecting the milk yield of each animal. These data are also an excellent guide for the breeder who practises cattle selection.

IX. — Organisation among farmers in Ohio, U. S. A. — Erdman describes the Economic and Agricultural Improvement Associations of the State of Ohio, and has co-ordinated all the information he obtained in the course of his visits to different farms, and by written and verbal enquiries. His reports deal with Purchase and Sale Associations, Agricultural Production and Improvement Societies, and Mutual Benefit Associations. The production Societies are divided into 2 groups, one of which consists of growers of cereals and owners of pastures, and is chiefly concerned with the improved economy of labour, while the other is composed of the manufacturers of butter, cheese and canned products. Among the organisations for the improvement of agriculture, the author mentions the Agricultural Bureaux, of which the chief objects are to increase production and to improve the conditions of rural life, Associations engaged in increasing the stock of cattle, in milk-testing, providing a service bull, increasing herbaceous and arborescent crops, and finally those Associations that arrange fairs and markets.

The first milk-yield testing Association in America was founded in 1905, at Fremont, Michigan. In Ohio, the first was instituted in 1909, and by 1917, there were 31 of these Associations, though since the war their number has fallen to 26. The tester, who is paid by the Associations, has to test the milk once a month.

The good effect of testing upon the increase of milk production is shown by the following figures relating to the Bornesville Association (which has been taken as a type).

Years	Average number of cows	Average production per head	
		Milk Lb.	Butter Lb.
1914–1915	350	5 793	289,8
1915–1916	301	5 594	283,4
1916–1917	364	5 923	308,5
1917–1918	351	5 974	313,9
1918–1919	290	6 845	345,4

536 - **Roman Cattle.** — Bianchini, B., in the *Rivista agricola romana*, Vol. XLVII, No. 34, pp. 91-109. Rome, March-April, 1921.

In Latium, cattle-breeding suffers much from the competition of sheep-breeding, which accounts for the fact that there are only 11 head of cattle per sq. km., a very small number for so large a province.

Two methods of cattle breeding are practised: — (1) Free grazing in the case of the pure local breed (the Podolian stock): (2) stabulation in that of imported breeds (Swiss and Dutch). The latter give a large amount of milk which, however, is much inferior in richness to that yielded by the Roman cows.

When the former system is adopted, the herds always remain in the open, and graze in the uncultivated fields and low marshy meadows, or even in the woods, where the cows usually pass the winter after calving. Cattle can turn to good account the shrubs and coarse grass that sheep refuse to eat.

The method of breeding practised is in-breeding and selection, and it is owing to this system that the Roman breed is the same to day as it was 19 centuries ago. Long inbreeding has given rise to no deterioration of the stock.

The characters of the Roman cattle are those of the Podolian race. The calves at birth have a wheat coloured coat, which only later assumes a lighter or darker shade of blue-grey. The height of the bulls varies from 1.50 m., to 1.68 m., and their live-weight is from 7 to 12 quintals.

Cows used for breeding purposes are known as " vacche da vita, " vacche da corpo " or " da frutto." Those weeded out annually on account of age or sterility, are sent to the butchers, and are called " cacciatore. " In the trade jargon, distinction is made between the " tronco delle vacche sode " (the group that has not yet calved) the " ambasciata delle vacche figliate, " (cows with small calves) the " partita delle mongarole " (the milch cows), the " branco dei torazzi. " (herd of young bulls), which are known under this name until they are 2 years of age; the "bravazzame," or calves of 6 months to 1 year, which are to be reared. At the age of 1 year, the calves are called "asseccaticci," later "biracchi," after being castrated they are known as "giovenchi" (young steers), and after thy have been trained (when 5 years of age), they are called "buoi" (steers) The steer works until it is 12-13 years old; when past work it is called a "camarro," and fattened for the butcher. The heifer of 2 to 3 years of age is called a "nutola" or "annutola." When 2 years old, it is served for the first time by the bull; after the second calving the animal is termed a vacca (cow).

When the bull has completed its 7th year, it is castrated otherwise it would be a dangerous animal. After this operation, it is known as a "maglione."

The calves of the "nutole" are never kept; they are allowed to suck their dams until they attain the weight of 200 kg. (Royal Decree of April 22, 1914, No. 49, and May 2, 1914 No. 506), when they are sent to the abattoir.

The Latium cattle seldom suffer from disease. Tuberculosis is almost unknown among them, they are little and very rarely attaced by infectious diseases, but they are much troubled by parasites.

They are chiefly used as draught animals, and in the present conditions of Latium, it would be impossible to find substitutes for them.

Their capacity of milk production leaves much to be desired. The average length of the lactation period is 7 months, 4-5 litres of milk being usually given daily, although some cows yield more than 8-10 litres, which proves that the perfomance of the breed could be much improved by selection, and still more by growing forage crops. The milk is excellent, much superior to that of the Swiss and Dutch cows kept at the dairy-establishments on the outskirts of the town. The specific gravity of the Roman cows milk can be as much as 1.037, it contains 6.5 % fat, and about 6.9 % of casein.

These unbroken cows are milked "alla rimessa," that is to say, in the open, in a quadrangular space surrounded by walls a or a "puntone" which means, in an angle formed by the meeting of two partitions.

The cow-herd ("vaccaro") of each group of 15 cows ("partita") milks his own cows, usually at 10 a m., and at 10 p. m. The animals are driven into the "rimessa," or "puntone," by the "appressataro" (1). When they enter, the cowherd calls each cow by its name and as soon as it, approaches throws a rope over its horns twisting it from a distance into a figure of 8 round the base of the horns, then he pulls down the cows, head to the left, and to the level of its foreleg, where he makes it fast, and then begins the milking operation.

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(1) The "massaio" is the manager of the "procoio," or "masseria". He assigns the pastures, weeds out the old animals, and is entrusted with the care and rearing of the cattle belonging to the estate of which he is the agent. He has under him the cowherds ("vaccari") whose chief work is milking the cows; the "portaspese" who drive the animals to the abattoir; the "coralino" or "casaro" (cheesemaker) who directly supervises the cowherds and measures the milk and milking-time; the "appressataro" (or chief man) who takes care of the dairy cows; the barozzari (the carters), who together with the "cavalcante" (riders), manage the transport, and break in the horses required for the work of the "procoio."

These cows can be tamed and kept in the cow-shed, in which case, their milk yield increasess, sometimes amounting to 7-9 litres a day for a lactation period of 7 months.

The abattoir yield of Latium cattle is low, on account of the great development of the skeleton, the thickness of the hide, the size of the horns, etc. Nevertheless these animals fatten well and although they keep their appearance of physiological leanness, they accumulate a fair amount of fat in the abdominal cavity.

Rejected animals that are being prepared for the butcher are kept for 2 months " ad erba netta, " that is to say, in a pasture which has not been grazed before. Only in exceptional cases, when they cannot pick up sufficient in the field, are they given a little dry forage.

Only " mongane " (suckling calves) are fattened in the true sense of the word. These, in addition to sucking their dams, are allowed, to take the milk of other cows. In this way, the calves increase their weight by 900-1000 gm. a day, and are soon ready for the butcher.

537 – **Influence of Rations Restricted to the Oat Plant on Reproduction in Cattle.** — HART, E. B., STEENBOCK, H., and HUMPHREY, C. G., in *Research Bulletin* No. 49, *Agricultural Experiment Station of the University of Wisconsin*, pp. 1-22, figs 24. Madison' November, 1920.

The authors have already published data bearing on the influence of growth and reproduction of nutrients derived from maize and wheat plants (1). The present publication is a continuation of this subject with a view to studying the causes of the deficiencies in the oat ration.

The cattle used for these experiments were grade Holstein heifers, brought into the experimental herd usually at the age of 16 to 20 months and ready for breeding. These animals were kept in a well lighted basement with access to an outdoor paddock free from all vegetation. Earlier experience had shown that growth could be secured on a ration made up of 7 parts rolled oats + 7 parts oat straw. In most cases the rations were made up on the basis of equal parts of roughage to equal parts of grain or grain substitute. Sodium chloride was fed *ad libitum*.

Results showed that a ration of oats was inadequate for efficient nutrition of breeding cows. The offspring were born prematurely and were either very weak at birth or born dead. Additions of the fat soluble vitamine or casein or of both of these nutritive factors to a whole oat-straw ration calcium salts either as a carbonate (wood ashes), as a phosphate or as calcium acetate showed a distinct improvement, and offspring of fair vigour were produced. This improvement in ration was secured even without the addition of a better protein or more fat soluble vitamine to the oat grain-oat straw ration. The chief deficiency in the oat plant ration was therefore apparently calcium. Variations in the calcium content of straw will naturally occur, depending upon the soils producing them.

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(1) See *R.*, Feb. 1918, No. 182. (*Ed.*)

The " synthetic " ration did not secure as strong offspring as the use of natural roughages such as maize stover, clover, alfalfa or marsh hay, (the latter grown on an alkaline marsh with remarkably good results).

From the data given concerning the nature and calcium content of the ration and condition of the offspring and cow, it appears that the ration of a dry breeding cow, where all other nutritive factors are satisfied, should contain at least 45 % of calcium oxide, calculated on the basis of the total ration. An air dried roughage containing 9 % of calcium oxide, provided it were fed as half of the dry matter of the ration, would probably be adequate in calcium oxide content. The authors consider it altogether possible that the calcium oxide figure advised as a minimum amount allowable in the ration of reproducing cows may be modified if the material is fresh, green plant tissue and not dried. On this point there are no data at present.

An hypothesis is given explaining the results secured, namely, that with generous sodium chloride intake and a low amount of calcium salts the surface protoplasmic films of the epithelial cells of the intestinal mucosa would present a structure in which water was the continuous phase, thus accounting for the fact that on low calcium rations there can be especially favourable conditions for continual absorption of products of intestinal origin among which may be bacterial toxins or amines.

Furthermore, attention is called to the practical significance of these studies with reference to forage and to acid soils.

538 - **Fattening Steers Without Feeding Maize Grain.** — See No. 471 of this *Review*

539 - **Fattening Native Steers for Market in Arizona, U. S.** — WILLIAMS, R. H., in *The University of Arizona College of Agriculture, Agricultural Experiment Station Bulletin*, No. 91, pp 355-396, figs 6, Tucson, Arizona, Sept. 1, 1920.

Starting on January 9, 1920, 36 steers averaging 889 lb. in weight were selected for a feeding test lasting 77 days.

Nine of these were high-grade Holsteins and the rest were mostly Holsteins sired by a Polled Shorthorn bull These cattle were divided into lots of 6 steers each

Lot I, consisting wholely of high-grade Holsteins was fed on alfalfa hay only (average daily ration per head, 28-63 lb.) and the average daily gain amounted to 1.40 lb. per head.

Lot II, average daily ration, alfalfa hay 8.99 lb. + maize silage 47.14 lb.; average daily gain, 2.39 lb.

Lot III, average daily ration, maize silage 61.76 lb. + cottonseed meal 2.66 lb.; average daily gain 1.96 lb.

Lot IV, average daily ration, alfalfa hay 4.20 lb. + maize silage 60.68 lb., + cottonseed meal 2.66 lb.; average daily gain 2.55 lb.

Lot V, average daily ration, — maize silage 52.70 lb., + cotton seed meal 2.66 lb. + ground silo maize 5.70 lb.; average daily gain 2.46 lb.

Lot VI, average daily ration, — alfalfa hay 3.97 lb. + maize silage 48.38 lb. + cottonseed meal 2.66 lb. + ground milo maize 5.77 lb.; average daily gain 2.49 lb. This lot occupies, therefore, the 2nd place as regards average daily gain, but the animals in this lot were much more uniform and fatter than those in Lot V, etc.

540 – **Comparative Values of Barley and Maize for Milch Cows.** — See No. 471 of this *Review*.

541 – **On the Extension and Improvement of Sheep-Breeding in Algeria.** — TROUETTE, G., in *La Vie Agricole et Rurale*, year X, Vol. XVIII, No. 13, pp. 200-301. Paris, March, 1921.

The author divides the Algerian flocks into the following three classes: the stationary flocks of the Tell district, the semi-migratory flocks of the high plateaux, and the far-travelling sheep of the southern region. (1)

In the Tell district (a region of vines and cereal), sheep-breeding does not occupy the prominent place that prudence would dictate, although there is no difficulty in finding shepherds, for the sons of the fellah, and the " khammes " can always be enlisted in this capacity, and modern methods can be applied with success, owing to the liberal food supplies and shelter, which are at the disposal of all the Europeans, and some of the native, stock-rearers.

On the high plateaux, the extension of colonisation has already encroached greatly upon the grazing grounds, but there are, however on these plateaux in three departments, vast tracts of uncultivated land belonging either to the State, or to native communities, where it would be possible to establish large sheep-breeding farms.

In the Southern regions, which include many tens of thousands of hectares, the existence or absence of pasturage depends upon the amount of the rainfall, and the intensity of the drought; further, the necessity of finding food for their flocks has constrained the shepherds to adopt a nomadic life and the annual migration of the sheep still persists.

In spite of these obstacles due to unfavourable environment the Algerian Administration is making every effort to change the pastoral system by increasing the watering places, this being the sole means of augmenting the number of the travelling flocks. In order to improve these continually migrating animals, the Authorities of the Southern district have founded the colonial sheep-farm of Tadmit, where selected stud animals are kept. This farm, which is situated in the valley of Oued Tadmit, 60 kilometres to the North-west of Laghouat, and only one day's march from the edge of the Sahara, has an area of 1500 hectares and together with the sheep-walks in its neighbourhood, is capable of supporting 1200 animals living under the general conditions obtaining in the South. The Administration is also directing its attention to the solution of various other problems affecting the future of the pastoral industry in Algeria.

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(1) See *R.*, Jan. 1917. (*Ed.*)

In order to extend and improve sheep-breeding in Algeria, the author advocates that special methods should be adopted according to the conditions of the different zones where it is practised; thus,

1) *In the Tell district*, where each farm has a stationary flock, improvement must be effected both by selection and crossing.

2) *In the high Plateaux*, large flocks should be grazed on the vast tracts belonging to the State or Communities; the grazing-rights being ceded for a term of years, and in a manner hereafter to be determined, either to Societies, or individuals, having ample capital at their disposal.

3) *In the South*, water-holes must be sought for; the proper care of these would at all seasons, save many sheep dying from thirst or from infestation by parasites, and would permit of pastures hitherto useless from want of water, being turned to good account. Selection is the only means of improving the sheep.

542 - **Maize By-product for Swine.** — Robinson, W. L., in *Monthly Bulletin, Ohio Agricultural Experiment Station*, Vol. V, No. 9, pp. 247-252. Wooster, Ohio, 1920.

This is a report on two experiments in which hominy feed was compared with shelled maize for feeding hogs and four in which maize germ meal was compared with maize or used as a supplement to maize. Experiments 1, 2 and 5 were conducted in the winter the others during the summer and fall.

Use of hominy feed and maize germ meal for feeding hogs.

	Feeds offered	ration of test	ial weight er head	aily gain er head	Consumed per pound of gain ize	 ize by roduct	 Prot in supple
				lb	lb	lb	lb
	Maize, skim milk	14	71,0	1.74	2.62	—	7.89
	Hominy feed, skim milk	14	70.4	1.39	—	2.71	8.11
2	Maize tankage (free choice)	15	68.3	1.27	3.99	—	0.44
	Hominy feed, tankage (free choice).	15	68.9	1.08	—	3.52	0.72
	Maize, tankage	16	49.5	1.24	3.29	—	0.20
3 *	Maize, maize germ meal, tankage	16	48.1	.98	1.93	1.93	0.15
	Maize, germ meal, tankage	16	48.9	.68	—	4.49	0.15
	Maize, tankage (12 : 1)	10	72.5	1.21	3.74	—	0.31
	Maize, germ meal. tankage (18 : 4 : 1)	10	66.1	.92	3.54	0.79	0.19
	Maize, tankage (12 : 1)	14	132.6	1.50	3.96	—	0.33
	Maize, germ meal, tankage (18 : 3 : 1)	14	129.2	1.55	3.47	0.58	0.19
	Maize, alone	15	62.4	1.14	4.45	—	—
	Maize, tankage (19 : 1)	13	59.8	1.31	4.25	—	0.17
	Maize, germ meal (3 : 1)	14	60.0	1 21	3.33	0.91	—

* Hogs on rape pasture.

It is concluded that the hominy feed used was scarcely as valuable pound for pound as maize. It is pointed out that at present manufacturers of hominy extract oil from the germs which are commonly included in the feed and that this reduction in energy value may account for the comparatively poor results from hominy feed in comparison with earlier results at the Ohio Station.

Maize germ meal alone was found to have a laxative effect. Apparently for best results it should not constitute a large percentage of the ration and when fed, should be used as a partial substitute for both the carbonaceous and the nitrogenous feed.

543 – **French Fish-Meal as a Pig-Food.** — VELU, in *La Vie Agricole et Rurale*, Year X, Vol. XVIII, No. 10, pp. 153-154. Paris, March, 1921.

As the by-product of the tinned-fish factories has not yet been used as a stock-feed in France, the author draws attention to the nutritive value of this substance, which has long been fed to all kinds of animals in Scandinavia, and the German-speaking countries; previous to the war, 40 000 tons were produced each year in England, 30 000 tons being exported to Germany. Much of it is sold under the name of "white fish meal," a standardised product containing no herrings, or similar fish.

In order to show that this fish meal should be widely used, the author carried out some experiments on two young pigs, of the same breed and age, and as far as possible, of the same weight. The animals were fed with different rations of fish meal prepared at La Rochelle and obtained by treating fresh fish in an autoclave: three hours was the time elapsing between the fish being taken from the nets and the discharge of the finished product from the apparatus. The composition of the French meal thus obtained was as follows: —

	%
Water	11.40
Proteins	60.02
Fats	9.68
Mineral substances	18.90
	100.00
Lime	7.60
Total phosphoric acid	7.03
Sodium chloride	1.52

In order to prevent errors due to individual peculiarities, the author adopted the plan of feeding the meal for periods of 40 days, separated by an interval of 10 days, during which the young pigs received ordinary rations; further, the experiments were inverted.

One of the rations contained meal, 200 gm. being given at the beginning of the experiment; the quantity was increased to 300 gm. by the end. Fish meal was substituted in equal amounts.

In the case of pig No. 1, (without fish meal), the daily increase in weight during the 40 days was 515 gm., and the cost per kg. of weight gained was 1 fr., whereas in that of the second pig (with fish meal) the daily increase in weight was 600 gm., and the cost per kg. of additional weight was 0.85 fr.

During the following 40 days, the weight of pig No. 1 (with fish meal) increased by 845 gm. daily, the cost of each additional kg. being 0.99 fr. while pig No. 2 (without fish meal) gained 574 gm. a day, the cost of each kg. gained being 1.29 fr.

With regard to mixing this highly nitrogenous food with foods poor in proteins, the author advises, especially in the case of Morocco, that it should be fed together with chopped, raw (preferably cooked) stems of the prickly pear (*Opuntia Ficus indica*).

The author also found that if fish meal is added to the rations of sucking-pigs that have been insufficiently nourished owing to the defective diet of the sow, or to the food of young pigs recovering from enteritis, the animals recover completely, regaining their former good condition and even putting on flesh rapidly. Further, the immediate arrest of the disease and the subsequent disappearance of the pathological symptoms have been observed in the case of three young pigs in the third stage of osseous cachexia.

544 - **Feeding Tests with Pigs, Using "Pig Meal" and "Pig Compo," in Australia.** — PERKINS, A. J., in *The Journal of the Department of Agriculture of South Australia* Vol. XXIV, No. 6, pp. 471-475. Adelaide, Jan., 1921.

The Metropolitan Abattoirs Board has recently placed on the market two meals prepared from its waste products and intended for the use ot pigs; they are known respectively as "Pig Meal" and "Pig Compo", and possess the following composition:

	Pig. Meal %	Pig. Compo %
Moisture	8.9	7.9
Ash	9.1	14.4
Protein	60.0	56.3
Fat	14.0	13.9
Undetermined	8.0	7.5
	100.0	100.0
Tricalcium phosphate	3.6	10.5

Definite proportions of crushed bones have been used in the preparation of "Pig Compo"; hence a decrease in the proportions of protein and fat and a corresponding increase in those of ash and phosphates.

Of the two meals, "Pig meal" has the higher feeding value; it corresponds to 85.5 starch equivalents, as against 81.1 for "Pig Compo," and the difference in value is reflected in their prices, which are respectively £. 19 and £. 18.5s per ton.

Description of Tests with Young Pigs. — Twelve young pigs were selected and divided up into 3 lots, A, B, and C. Their means were as follows: —

	lb.
Lot A	53.75
Lot B	69.00
Lot C	75.00

During the first fortnight these pigs were fed as follows (per head per day).

Lot A	2 3/4 lb. crushed barley.
Lot B	2 lb crushed barley + 1/2 lb. pig meal.
Lot C	2 lb. crushed barley + 1/2 lb. pig compo.

During the second fortnight, the barley allowance was increased all round by 3/4 lb., per head per day, and lot A was supplied with pig meal and lot B with pig compo, whilst lot C was fed with barley alone.

During the third fortnight lot A was supplied with pig compo and lot C with pig meal, whilst lot B was fed with barley alone. During this period the barley allowance was increased by 3/4 lb. in the first week, and by an additional 3/4 lb. in the second week.

The average increase in weight per head per day is given as follows:

	Barley alone	Barley and Pig meal	Barley and Pig compo
Lot A	0.42	1.76	1.36
Lot B	0.26	0.77	1.42
Lot C	1.04	1.37	0.77
Means	0.91	1.30	1.18

By substituting in the rations of young pigs, 1/2 lb. pig meal or 1/2 lb pig compo for 3/4 barley, there has been an increase in live weight of 0.39 lb., and 0.27 lb., at a cost of 1.64 d and 2.22 d per lb. live weight respectively.

545 - **Experiment on Grazing Pregnant Sows on Irrigated Meadows (Rieselgrasweiden) in Germany.** — MULLER and PRIESHOF, in the *Deutsche Landwirthschaftliche Tierzucht*, Year XXV, No. 1, pp. 7-8, Hanover, January, 1921.

The experiment in question was carried out at the Ruhlsdorf Experiment Farm for the keeping, feeding, and breeding of swine; three fertilised sows of different breeds were used. The object of the experiment was to determine whether pasture irrigated by water-channels would provide sufficient food to maintain pregnant sows of different ages without the addition of supplementary rations, and to find out how many animals an area of 0.25 hectares could support.

The pasture was 1.5 km. from the pig-sties. The pigs were taken to graze twice a day, morning and evening; they remained in the field from 2 1/2 to 3 hours, returning always at midday, and thus walking 6 kilometres every day. The experiment lasted from May 25 to September 14.

From April 14, the pigs grazed in the field twice a day and thus were well prepared for the experiment.

The grass they ate in the meadow was quite sufficient food for the sows at an advanced period of gestation ; in fact the animals gained as much as 16 kg. in weight during the course of the experiment. As a rule, no great difference was observed between the pigs of various breeds, and it thus appears that Large White Yorkshires are also good grazing animals, provided they have a head of average length, and well developed jaws.

In addition to the older sows, 5 younger ones were used in the experiment, 3 of the latter were the result of a cross between the Yorkshire and Hanover breeds, and these gained 10 kg. in weight during 16 weeks. The area of the pasture was 0.55 ha. and the number of grazing pigs varied from 9 to 20. On an average, 16.7 animals were kept on the field, so that 0.25 ha. was sufficient for 7.6 pigs. The total area was divided into 3 lots, each being grazed 4 times in succession. Each pig consumed about 15 kg. of grass a day.

Taking the market-price of a quintal of grass from the irrigated field at 7.41 fr. (1 *mark* at par = 1.2246 fr.) the cost of the pigs amounted to 1.11 fr. per day per head.

The results of the experiment shows that grass from a meadow watered by irrigation channels is an excellent and cheap food for pigs, and much more nutritive than comfrey (*Symphytum asperrimum*). As the grass yield is larger than that of comfrey, this method of feeding greatly reduces the cost of pig-rearing, especially in the case of pregnant sows and of young sows.

The authors advise pigs being fed on this forage throughout the year and suggest that the grass should be preserved by converting it into sweet silage.

546 - **Bee Keeping in the Belgian Congo.** — VANDEVELDE, in *La Meuse*, Liege, January, 22, 1919, reprinted in l'*Apiculteur* Year LXV, No. 3, pp. 72-74. Paris, March, 1921.

Information furnished to the author by E. MICHEL, Agricultural Engineer, of the Belgian Colonial Ministry.

Bees are to be found throughout the Congo ; in some regions, they are very numerous, and collect in large swarms in the hollow trunks of trees and in crevices in rocks.

The natives are very fond of honey, but they make no use of the wax. Their method of taking the honey leaves much to be desired, for they kill the bees in order to obtain it and pay no heed to keeping the swarms, but let them fly away.

In some districts, the natives make very primitive hives constructed of pliable twigs, tree bark, and plant fibres. These hives are cylindrical in shape, and about 1 m. long, their internal diameter being 30 cm. The two openings are closed by lids, one of which is perforated, so as to make a flight-hole a few centimetres in size.

When the time for collecting the honey comes, the natives open the hive at the back, and introduce smoke into it when the bees escape through the flight-hole. Then the combs are removed and ground up in order to extract the honey.

Congo wax, when well purified, is usually as good as the European product. Further, its collection, like its preparation and refining, presents no difficulties.

In 1914, the Central Administration of the Congo, had several samples of wax from the Colony examined. Some of them were of good quality one or two being even first class, and possessing the special aroma peculiar to foreign wax. The Congo product can be compared with Benguella wax, and would probably bleach well in the sun. The sample examined was valued at 340-360 fr. per 100 kg. on the wharf at Antwerp.

The Congo waxes have been investigated at the Analytical Laboratory of Louvain, and shown to possess the same physical constants as the Belgian wax.

Wax is a new article of export from the Belgian Congo, and should not be neglected. Hitherto very little of this commodity has been sent to Belgium; imports have been: — in 1905, 220 kg. valued at 165 fr.; in 1916, 3950 kg worth 15800. fr., in 1917, 15 741 kg. worth 66 899 fr.; in 1918, 2091 kg.

FARM ENGINEERING

547 - **Power Farming in Canada.** — BLACKWOOD, W. C., in *The Agricultural Gazette of Canada*, Vol. VIII, No. 1, pp. 49-50 Ottawa, Jan-Feb. 1921.

The Physics department of the Ontario Agricultural College, by correspondence with more than two hundred farmers who are using tractors, has ascertained facts relative to the comparative value of horse-power and other form of power on the Ontario farm.

The statements are not based on information received where answers to questions, differed, respecting the relative merits of horse and tractor power, or where the efficiency of the tractor for any phase of farm work was questioned 1) Most farmers agreed that horse-breeding was slightly on the decrease, but thought that other factors rather than the advent of the tractor were responsible for the decrease.

2) Tractors in large numbers have been used for so short a time that there has not been an opportunity of investigating the effect tractors will ultimately have on the number of horses on the farm.

3) The only horses that have been displaced are those kept for peak load during the spring months.

4) Total horses disposed of in 17 counties on 92 farms, from which returns were received, was 169, about 2 horses per tractor.

5) Many have not as yet disposed of their horses, as they are holding them for better prices. There will, therefore, in the near future be an increase in the number of horses displaced by the tractor owners from whom information has been received.

6) As to economy, 54 out of 92 considered their tractor a profitable investment, 32 did not know, and 6 replied in the negative. The farmer in most cases had not kept strict enough account of the cost of each horse per year to be able to give a definite answer as to the economy of the tractor relative to the horse.

7) Improved work with the tractor seems to be a significant factor.

8) So far as the replacing of " horse " power by electrical power is concerned there is as yet no available information which would lead one to believe that the influx of electrical power has had any marked effect on the horse problem on the farm.

9) Electrical systems are proving exceptionally efficient and are gaining in favour every day, according to reports received by the department.

In electrical systems we include both hydro light and power, and gas electric systems.

548 - **The Samson Tractor.** — DESSAISSAIX, R., in *Journal d'Agriculture pratique*, Year LXXXV, Vol. I, No. 13, pp. 256-257, 1 fig. Paris, April 2, 1921.

The Samson tractor, which is of American origin, is sold by the General Motors Export Co. of New York, represented in France by a Branch Office at 63 Avenue des Champs Elysées, Paris.

The motor of the Samson tractor is made at Janesville (Wisconsin), it has 4 vertical cylinders of 0.102 m. bore and 0.140 m. stroke. It can develop 20 H.P. Its two speeds are about 3 000 and 4 500 m. an hour, and its reverse is 2 000 m.

The hind driving-wheels are provided with oblique rims, they are 1.14 m. in diameter, and have tyres 0.30 m. wide. The front wheels are 0.68 m. in diameter, and their tyres are 0.10 m. in width. The chief dimensions of the machine are as follows: total length 2.75 m.; total width 1.50 m.; height 1.40 m.; weight empty 1 400 kg.

The tractor can run on either paraffin, or petrol, which is an important fact as regards the cost of fuel.

Like many other American machines, the Samson tractor can be driven and steered by the driver from his seat on the machine that is being towed. He steers by means of jointed shafts provided with indicators, the first of which telescopes into a long tube. The tractor can thus be driven with the greatest ease, especially as the driver has the work of the binder under his eyes, and by means of a rope can regulate the transmission from the motor to the driving-wheels of the tractor.

The motor of the Samson tractor has an automatic speed regulator, this is indispensable when it is used to work a belt-driven farm-machine.

549 - **An Apparatus for Making Ligatures.** — PASSELÈGUE G., in *Revue horticole*, Year 93, No. 61, pp. 283-284, 2 fig Paris, April 16, 1921.

In all operations entailing the handling of liquids, flexible tubes (of canvas or rubber) are fastened at their point of attachment by means of ligatures, which must be very firm, in order to prevent leakage. These ligatures consist either of a close spiral of wire to make which needs manual dexterity, or of attachment collars; of these latter many different types are on the market.

The apparatus shown in fig. 1, which has been invented by A. MANONCOURT, 76 Boulevard Saint-Germain, Paris, and is known as the "Ligaturateur universel" renders it possible to make with rapidity ligatures for tubes of any diameter. It is used in horticulture, for attaching watering-hose, in wine and spirit warehouses where wine, cider, beer, vinegar, alcohol, etc., have to be handled, and also in explosion motors (for the circulation of water).

The body of the apparatus *C* ends in a foot *P*, this projects slightly, and has a notch at its extremity. In the body, an endless screw *V* can turn, this is worked by a milled head, and the nut *E* carries a slotted stud in the groove.

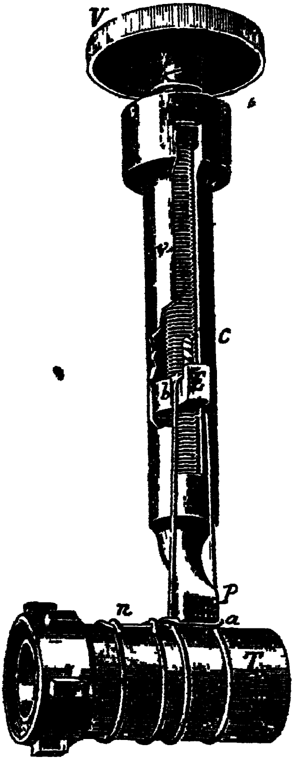

Fig. 1.
« Ligateur universel »
MANONCOURT

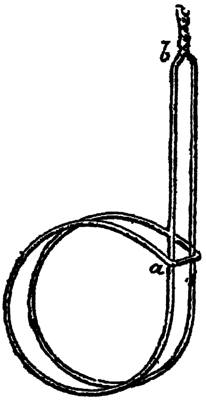

Fig 2.
Ligature made by
this apparatus

The ligatures are prepared in advance (fig. 2), they are rectangular in shape, their width *a* being equal to that of the foot *P*, and their length *b* exceeding the external circumference of the tube. These ligatures may consist, as the case requires, of round or flat wire or of a flat piece of steel with two parallel arms. A slip-knot is made round the tightening tube, as is shown by fig. 1. After having pushed the stud *E* as near as possible to the foot *P* (the milled head *V* having been unscrewed) it is placed on *b*, the free part of the ligature, the foot being in *a*. The head *V* is screwed home, in order to tighten the ligature; if necessary a few taps of the hammer can be given to make the wire take the shape of the tube, a second tightening blow is given, and the apparatus is pushed forward. The milled head is then unscrewed, and the wire cut, leaving two little hooks that are hammered down, as is seen at *n*. According to the length of the juncture, 2 or 3 ligatures are placed, one beside the other.

The apparatus usually employed has a total length of 0.23 m., and a travelling distance of 0.12 m. It is furnished with a certain number of ligatures suitable for tubes varying in diameter from 0.01 m. to 0.06 m.

A similar, but smaller, apparatus also exists; the total length of this is 0.14 m. and its travelling length is 0.07 m. It is especially suited for laboratory work, as it allows of narrower ligatures being used, such as are needed for vacuum rubber-tubing, gas-burners, ovens, etc.

A stronger apparatus worked by a winch-head is made. The total length of this machine is 0.48 m., while its travelling length is 0.30 m. This is intended for tightening ligatures of considerable diameter, and made of a material that is compressed during the operation. It is used in making bales of fibre, cotton, fascines and faggots, and for clamping boxes, ringing casks, etc.

RURAL ECONOMICS

550 - **The Cost of Threshing in France.** — DE MONTARD G., in the *Journal d'Agriculture pratique*, Year LXXXV, No. 2, pp. 29-30 Paris, January 13, 1921.

In a recent article, RINGELMANN has shown how much it is to the interest of agriculturists to form cooperative threshing societies (1).

The author had to do with such a cooperative society in a district where it is the custom to pay, not for the hours worked, but for the hectolitre of grain threshed. Before the war contractors asked from 60 to 70 centimes per sack of grain when threshing-machines without a straw-stacker were used, and 10 centimes more when the apparatus was furnished with this modern appliance. A difference of 10 centimes was always made between the threshing-price of wheat and that of other cereals (2). In 1920 farmers that supplied wood for the engines were charged from 3.50 fr. to 4 fr., whereas the others had to pay 4 to 5 fr. It appears that as much as 6 fr. per sack was asked when the threshing-machine was provied with a straw-stacker; the same price being paid for all cereals.

The Cooperative Society was started during the war by two motor cultural syndicates in the same canton. The threshing machine used was oneof *Ransomés*, a speedy worker bought as a bargain in 1917 for 7500 fr. The number of the members was 20. As the properties were much divided, the number of threshing-floors was somewhat greater, there being about 30. The hectolitres threshed from July 21 to September 5 (1) were 4514 in all (wheat 1738, oats 2729, rye 2 (2), barley 38, and spelt 7).

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(1) See *R.*, Mar. 1921, No. 333.)*Ed.*)

(2) The prices were raised in years of bad crops. The contractors used small, simple threshing-machines which left the grain unwinnowed (small machines driven by motor power or horse power), payment being made not per sack, but by the heap of 12 sheaves handmade sheaves). The machines are rarely used. (*Author*).

Net Cost of Threshing One Sack on 5 Farms.

	1		2		3		4		5	
	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
		fr.		fr.		fr.		fr.		fr.
Mechanic (days) . .	1/2	6.00	1/2	6.00	1	12 00	1	12.00	2	24.00
Grain feeders (days)	1/2	10.00	1/2	10.00	1	20.00	1	20.00	2	40.00
Oil . . . . . . litres	6	21.60	6	21.60	—	—	—	—	16	57.60
Paraffin	37	61.40	52	169.65	—	198.50	—	189.20	204	239.25
Tax on:										
Sacks of wheat . . .	21	18.90	14	12.60	95	76.50	50	45.00	110	107.30
Sacks of other cereals	—	—	40	32.00	66	52.00	52	41.60	145	116.00
Total cost	—	**117.90**	—	**251.85**	—	**359.00**	—	**307.80**	—	**583 95**
Cost of threshing a sack of cereals . .	—	5.63	—	4.65	—	2.39	—	3.00	—	3.20

Each member's share of the expenses was based on the following

I. — *Wages.* — Each member pays for the days the mechanic and grain-feeders spend on his property. The grain-feeders wages were 10 fr. per day. One syndicate paid its mechanic 25 fr. The mechanic of the other syndicate only received 12 fr. but the syndicate paid for the threshing of his little crop, providing him with paraffin, oil and grain-feeders work, and remitting the sack tax.

II. — *Oil, paraffin.* — Each member provides his oil and paraffin. The syndicate has purchased these commodities this year.

Oil if bought through a cooperative society, can be sold to the members at 3.60 fr. per litre. The net cost of petrol and paraffin at the Station is 240 fr. and 165 fr. per hl., respectively.

III. — *General expenses.* — Under this head come: —

a) Repairs; these were very considerable this year, the machine having been driven carelessly during the last season. There was one heavy item; a new driving-belt.

b) Insurance premiums; these were somewhat low.

c) The wages of the mechanics and grain-feeders during removals or repairs.

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(1) The work was interrupted for a few days during the local fairs.

(2) As a binder is little used on account of the sub-division of the properties, and the presence of plantations of trees etc., rye-straw is used for binding, and all the rye is threshed at the time it is harvested before the threshing season.

d) The oil and paraffin used on the road when changing threshing ground.

e) The petrol required for starting the machine; heavy oil, cleaning, rags etc.

f) Sundry expenses (meetings, correspondence, returning packing materials, advances of money, etc.)

g) Amortisation and interest paid on parts of threshing machine.

h) A payment of 0.10 fr. per sack to the motor cultural syndicate lending the tractor. (1)

i) The threshing expenses of the mechanic of the second syndicate. In order to cover all the expenses under the head of general expenses a tax of 0.90 fr. is levied on each sack of wheat and of 0.80 fr. on each sack of oats.

An examination of the appended table will show, that the cost of threshing a sack of grain varies greatly according to the crop.

The figures given show that:

1) As a rule, it is to the interest of a cultivator to belong to a cooperative threshing society.

2) He must choose machines that meet his requirements. A large tractor and thresher are not needed for a small crop. The reason that this rule was not carried out in the case entered in column 1, is because the small property lay between two larger ones where the thresher was being used, and which belonged to the same owner. A cooperative society that is well established can have 2 machines: a large thresher for large threshing-grounds, and a motor thresher for small ones.

3) Large yields are to be aimed at: columns 3 and 4 refer to two threshing-grounds where the work lasted the same time and neary the same amounts of oil and paraffin were used. The rich crop paid 0.60 fr. per sack less than the other. Thus cooperation puts a premium on production.

551 - **Studies on the Economic Valuation of Fodders.** — I. JOVINO, S., Della razione e dei foraggi più economici, in *Le Stazioni sperimentali agrarie italiane*, Vol. 48, No. 6, pp. 556-582, 8 tables, Modena, 1915. — II. GRABER, H., Neue Richtlinien der Fütterungspraxis, in the *Wiener Landwirtschaftliche Zeitung*, 1920, No. 20; extract from *Biedermanns Zentralblatt*, year 49, No. 12, p. 463. Leipzig, December, 1920. — III. GOUIN, R., La valeur marchande des aliments du betail d'après leur valeur nutritive, in the *Journal d'Agriculture pratique*, year 85, Vol. 1, No. 14, p. 276. Paris, April, 9, 1921.

I. THE MOST ECONOMICAL RATION AND FODDERS. — The author begins by giving some data concerning: 1) The decrease in the average digestibility of foods that results from the amount fed, that is to say the ration; hence the law of the "*final degree of digestibility*", namely, the digestibility of the last of the infinitesimal amounts of food into which the author supposes the daily ration to be divided; 2) the "*degree of utility*" of the food, or the proportion between the energy or substance the animal actually obtains from the ingested food (all the losses in transformation being subtracted) and the total amount of the food; 3) the decrease in the *average and final degrees of utility* with the increase in the ration.

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(1) This arrangement will have to be altered, for the use of motor ploughs is much less common now owing to the cost of paraffin, difficulty of finding a driver etc, and the amortisation of the tractor would be insufficient. (*Author*)

This having been enunciated, the author expresses the final degree of utility in the function of the amount of the food, or ration x: —

$$y = a\,x^2 + h\,x + c$$

and obtains, by integration, z as the average degree of utility;

$$z = \tfrac{1}{3}\,a\,x^2 + \tfrac{1}{2}\,h\,x + c$$

By cow-shed experiments, where the total utilisation of the food is calculated by the daily weighing of the cattle, milk, butter or cheese, according to the zootechnical production, the constants of the function z may be calculated by means of 3 simple equations, and inserted into the previous equation. This having been done, if m represents the market price of 1 kg. of food after subtracting its intrinsic fertilising value, p the market price of the refined product, the most economical rations is given by

$$m\,dx = p\,y\,dx.$$

$$\text{or by } y = ax^2 + hx + c = \frac{m}{p}$$

The author describes the cow-shed experiments carried out during the winter 1913-1914 upon 3 Schwyz milch-cows belonging to the "R. Podere dimostrativo" of Matera (Basilicate), in which the food given consisted of a special mixture consisting of linseed cake, wheat sharps, sulla hay, mangolds and cereal straw. The analysis is given; 3 to 4 experimental rations contained respectively 12-24, 13.87, 15.50 and 17.13 kg. of dry matter per head, fed at successive periods varying from 6 to 9 days. The author concludes from the results of the experiments, that: — 1) Taking the average of the 3 cows, the most economical ration was (under the conditions of the market at the time), 33 of dry matter per 1000 parts of live weight if the milk was to be sold, and 29 if it was to be made into "mozzarelle"; 2) an excess of food is more wasteful the greater the age of the animals, and the more remote the date of calving; 3) KELLNER's rules, in this case, were in complete agreement with practical results.

The author then deals with the question of selecting the most economical fodders on the market, and shows that it is a mistake to begin by neglecting all the products already on the farm according to some system of nutritive unit; the only rational system is that which is based on the forage substances existing on the farm and which compares the cost of certain quantities of foods, whether unmixed or mixed, that are *isonutritive* among themselves, that is to say, contain the same amount of digestible albumen and starch equivalents, as these are the two great indices of the intrinsic nutritive value of forage. Given 3 foods with the following percentage composition:—

Food	Digestible albumen	Starch Equivalents
f'	e'	a'
f''	e''	a''
f'''	e'''	a'''

and with which it is desired to make (using *v* kg. of the 2nd and *w* kg. of the 3rd) an isonutritive mixture wth 100 kg. of the 1st we shall have: —

$$\left\{ \begin{aligned} v &= 100 \frac{a' e''' - a''' e'}{a'' e''' - a''' e''} \\ w &= 100 \frac{}{a'' e''' - a''' e''} \end{aligned} \right.$$

Isonutritive mixtures having been made of farm products and foods bought on the market, a single ingredient is selected for reference (if possible a cheap one) and with this are compared from the point of view of cost, the other foods on the market, preference being given to the isonutritive substances which are inexpensive and, at the same time, adapted to the special animal product required.

The author mentions practical instances.

II. NEW VIEWS CONCERNING FODDERS AND THEIR USES. — The albumen contained in foods is better used in milk production than in the production of fat. For this reason, GRABER approves of HANSSON's suggestion that in determining the cost of food production, the digestible albumen should be multiplied by the factor 1 43, in order to obtain the *milk value* (*M W* = Milchwert) of the foods, and not by 0 94, as is done by KELLNER in order to obtain the *starch value* (*S. W.* = Stärkewert) forages to be used for fattening stock.

The author speaks of the value of amides, enzymes, and more especially vitamines (which he calls *biophores*) in feeding, and in the production of animal energy or substance. He explains why raw or cooked beets are equally good for milk production, whereas raw or slightly steamed potatoes increase the milk yield more than boiled potatoes. He also shows the reason why cooking foods is, as a rule, rather useless than injurious, and why the economic objections raised against the use of germinated grain are as groundless as those directed against silage.

The author does not consider the present chemico-agricultural means of estimating forage sufficiently exact, and he advises agriculturists to use the once celebrated system of PIRQUET devised for estimating the value of various foods in the maintenance of the human body.

PIRQUET took as the unit of nutrition the *Nem* (Nahrungs-Eiheits-Milch), which represents the cost of production of 1 gm. of normal milk containing 3.5 % albumen, 3.7 % fat and 5 % sugar. (1). There are multiples of this unit, such as *Kn* (*Kilonem*), *Hn* (*Hectonem*) etc. The author expresses the multiple 100 *kn* by *Pq* (= 1 Pirquet). In the human body, feeding with 1 *Nem* produces 567 small calories.

In rationing, PIRQUET adopt as a reference size, the height of the human body when seated ("Sitzhöhe") expressed in *cm.* and represented by the symbol *Si*. The measurement is taken from the horizontal plane on which the person is seated to the top of his head. Si^2 gives the intestinal, or absorption, surface, or *Siqua*, in sq. cm., and $\frac{Si^3}{10}$ represents the weight of the body in grammes, in the case of men of normal height. A man engaged every day in arduous work requires an amount of normal milk equal in volume to the *Siqua* for every 1 cm. of height; this is expressed by *Siquanem* and represents the food maximum. On the other hand $\frac{1}{2}$ *Siquanem* only represents the maintenance ration, and from $^4/_{10}$ to $^7/_{10}$ of the production ration for work ranging in nature from moderate to very arduous.

In order to apply the PIRQUET system to stock foods, GRABER first shows that by dividing the starch value of these substances by 16.43 (Starch-value of 1 quintal of normal milk), or the milk-value by 18.15 (N. W. nutritive unity) of 1 quintal of normal milk), the units *Pq.* are obtained. The author considers that there is complete agreement between the facts deduced by PIRQUET from the calories of transformation, and the practical data, both as regards meat and milk production.

In order to show the amide and vitamine content of the foods, GRABER suggests adding to the figures representing the nutritive units expressed in *Kn* or *Pq* the letter *a*, if the food is rich in starch, and *h* if it has a high vitamine content. Thus, to produce 10 kg. of milk with 500 kg. of live weight, it would be said that an average of 30-33 *ahkn* were needed, less being required if the forage was green, fresh and succulent, that is to say, rich in *a* and *h*, and more if it was dry. If the vitamines of seeds only develop after germination *h* is put in brackets. Thus, the food value of 1 quintal raw peas is expressed by 4 (*h*) *Pq*.

III. MARKET VALUE OF CATTLE FOODS RECKONED ACCORDING TO THEIR NUTRITIVE VALUE. — The considerable variations in the price of food stuffs at the present time makes it very necessary to find out which are the most economical. The author, while frankly admitting that the present methods of determining the value of cattle foods which are based on nutritive and imaginary units are wholly conventional, and do not give accurate results, nevertheless considers the least imperfect of the methods to be: — *a*) The nutritive units calculated from KELLNER'S starch values and adopted in France in the compilation of MALLÈVRES' tables; *b*) the Danish method in which the nutritive unit is represented by a kg. of barley-corn which is almost always $^2/_3$ of the starch value (1)

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(1) The PIRQUET method, founded on the comparative food value of woman's milk is also widely used in America. Cf. *Die Ernährung der Pflanze* year 17, Nos, 5-6, p. 85, Berlin, March; 1921. (*Ed.*)

The author describes the methods of estimating the economic value of cattle foods calculated by means of the different nutritive units adopted by MALLÈVRE, KELLNER, WOOD and HALNAN, GRANDEAU, and by Danish workers.

If the choice is between oats, groundnut cake and hay at the present market prices, calculation shows that groundnut cake gives the cheapest nutritive unit, no matter by what method the calculation is made (2).

552 - **Probable Profits from the Cultivation on the Banana in India.** — See No. 509 of this *Review*.

553 - **The Importance of the Stock Reared on Large Estates as a Source of National Food Supply in Germany.** — *Deutsche Landwirtschaftliche Tierzucht*, year XXIV, No. 33, p. 337-339. Hanover, April, 1920.

The socialistic and land-distribution schemes at present being carried out in Germany, which will inevitably bring about the subdivision of the large country estates for the purpose of solving the problem of obtaining an adequate food supply for the nation, are a matter of serious anxiety to experts and the interested parties. The chief points under discussion are the advantages and disadvantages, from the standpoint of political economy, of the small farm.

The author, taking as his basis a pamphlet published by the Union for the Reform of Country Estates " Reformbund der Gutshöfe " and entitled " Communal Provisioning and the Country Estates " (*Städtische Versorgung und Gutsbetrieb*), proposes to demonstrate the incontestable superiority of the well-managed large farm, as regards the amount of stock reared, over an equally well-managed smaller holding, and further to show that the parcelling out of a large estate among small holders entails disadvantages that from the point of view of political economy far outweighs any advantages that might accrue to any individual small holder.

The following arguments and examples have been selected from a large amount of statistical material: —

1) An estate in Upper-Hesse, situated in two communes in the neighbourhood of Friedberg. The average communal land is richer than that of the estate.

The following figures show the consignments of products made during the year 1918.

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(1) In Scandinavia, the barley value method is also adopted, but if local barley is used, the barley-value, especially from the point of view of milk production, is 72 % of KELLNER's starch value. Cf. *R.*, February 1921, No. 177.

(2) MARENGHI is of opinion that the nutritive unit (leaving the farm fodders out of account) could be used in commercial transactions but only to show the compensation to be given, on account of the slight difference between the guaranteed value and the found value of the fodder. See *R.*, Feb. 1920, No. 248. (*Ed.*)

Estate (40 hectares under cultivation)		Communes (93 hectares under cultivation)	
Consignments of dairy produce:			
78 cows . . .	155 415 litres of milk	187 cows . . .	44 220 litres of milk
» . . .	4 932 pounds of butter	» . . .	no butter
per cow	1 992 *litres of milk*	*per cow* . . .	236 litres of milk
» »	63 *pounds of butter*	» » . . .	no butter
Consignments of butchers' beasts:			
36 cows and heifers		37 cows and heifers	
28 calves		70 calves	
per 100 *ha.* of *land:* 15.5 *cows and heifers*		*per* 100 *ha of land:* 8 *cows and heifers*	
per 100 ha. of land: 11.8 calves		per 100 ha. of land: 15.2 calves.	

2) An estate in the *Bezirk* of Giessen with an area of 134.50 ha. is situated in a Commune farming 316.25 ha. The consignments made in 1918 were as follows.

	Milk	Meat
Consignment from the estate	99 550 litres	52.50 quintals
» » » commune	104 584 »	42.00 »
» » a portion of the communal land of the same area as the estate. .	44 500 »	18.00 »
Consignments from the estate as compared with those from the communal land . . .	224 %	292 %

3) A very interesting comparison was made by the "Reformbund der Gutshöfe" in the *Bezirk* of Budingen, between 5 estates and 6 communes belonging to that *Bezirk*. The figures refer to 1918:—

Consignments of Milk.

	Communal farms	Estates
Total consignments	481 232 litres	472 950 litres
Average number of cows (according to official census)	919	260
Area cultivated	1 938.10 ha.	687.60 ha.
Annual yield per cows.	524 litres	1 819 litres
Per 100 ha of total area	24 830 »	68 783 »
Consignments made from the estate compared with the communal consignments · per cow	—	347 %
Per 100 ha of total area.	—	277 %

Consignments of Butchers' Beasts.

	Communal farms	Estates
Cattle total consignments	254	108
Small stock (calves, swine, goats	277	107
Cattle consignments per 100 ha of area . .	13.1	15.7
Small stock	14.3	27.2
Cattle consignments from the estate compared with the communal consignments	—	120 %
Small stock	—	190 %

The statistics given above come fiorm official sources as regards cases 1 and 2, whilst the data respecting No. 3 were compiled by the " Reformbund der Gutshöfe " under the direction of experts. Emphasis must be laid upon the fact that the extra productivity of the two estates was obtained from fertile soil worked by peasants recognised as being progressive. Had the conditions of soil and climate been less favourable, the differences in the agricultural production (" Ertragsunterschied ") of the communal farms and of the estates would have been still more accentuated, seeing that under such conditions, the latter enjoy superior technical and economic advantages As regards meat production, it is seen that the small holdings are not by any means of supreme importance for the provisioning of urban centres, as has also been proved by thé enquiries set on foot in the Darkehmen *Bezirk* and confirmed by Dr. ULRICH KAHRSTEDT in *Ein Beitrag zur Frage des Siedelungsgesetzes* (Study in the Question of the Law of Home-Colonisation), Printing Office of the *Deutsche Tageszeitung*, S. a. à. r. l. Berlin. As regards the regions in question (the Republic of Hes and the Province of Hesse-Nassau), the above statistics show very clearly that small farms in these districts have no sure future before them, any more than in East Germany. Where large consignments of meat have been made, this has only been done by certain urits (*Wirtschaftseinheiten*) which have given themselves up wholly to the stock-breeding industry to the neglect of all other branches of agriculture, and at the expense of a consumption of food stuffs that is by no means justifiable under present conditions. Further, if the large estate were to develop one branch of agricultural industry to the detriment of the others, its production in this special line (Sonderleistungen) would be as superior to that of the smallholdings as its general production has been shown to be.

It may be urged against the argument of the great provisioning-value of the relatively larger number of stock kept by the peasant-farmer, that the number of draught-cattle per unit area is very large, owing to the farming-methods adopted (" Wirtschaftsform "). Draught-cattle give but little or no meat and milk, all the food they consume going to supply the energy used in their work, so that they reduce the human food supply, either directly or indirectly. The use of draught-cattle, even where it is inevitable, is the great disadvantage of the above-mentioned farming methods. Again, as regards the employment of any kind of machine, the large farm is in a far better position than the small one, and is able to reduce the cost of draught-cattle, even where the motive power is still exclusively furnished by animals.

From what has already been said, it would appear that the large estate is superior to the small farm, not only in total food production, but also in the amount of food produced per unit area.

The author is of opinion that these differences of production are not confined to the region of Upper Hesse, but exist in all the districts of the South and West of Germany where the subdivision of landed property has taken place.

554 - **Methods of Fixing the Price of Milk** (1). — I. MERTZ, I. and DESMOULINS, I., in their Study entitled *Le Payement du lait à la matière grasse*, pp. 1-90. Librairie Agricole de la Maison rustique, 26 Rue Jacob, Paris, 1920. — II. MURRAY, A. H., in the *Agricultural Gazette*, Vol. XCI, No. 2408, pp. 201-202. London, February, 1920. — III. PORCHER, C. and VITOUX, H., in *La Vie Agricole et Rurale*, Year X, Vol. XVIII, No. 7, pp. 99-101. Paris, February, 1921. — IV. RAUCH, in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXIV, No. 49, p. 510. Hanover, December 3, 1920.

The problem of fixing the price of milk upon a settled basis, especially the price of milk bought by Co-operative dairy societies and dairy industries for the manufacture of butter, cheese, condensed milk, etc., has been studied by different authors. The following is a summary of their articles on the subject.

I. — This study is divided into two part; in the first, the authors give advice regarding the creation of a Co-operative Dairy Society, and the choice and fitting up of the premises; in the second, they show the necessity of estimating the value of milk according to its fat content, which would introduce a new basis for the price and testing of milk, and a different method of dairy book-keeping, and demonstrate the great advantage of the new system over payment by weight, viz., 1) the better testing of milk delivered by farmers; 2) the individual estimation of the milk supplied; 3) the economy realised by the cooperative society; 4) the stimulus to great production by means of selection and feeding; 5) payment in proportion to the richness of the milk supplied, its acidity being taken into account, so that each member receives his due.

The price of the milk should be estimated from samples taken every day, mixed and tested every week in a GERBER apparatus. The three or four careful texts thus made during the month, would permit of the estimation of the exact amount of butter fat supplied by the members, who should be paid by dividing the receipts at the end of the month equally among the number of kg. of butter made at the factory during the month ; the general expenses being divided among the members in proportion to the members of litres of milk supplied by each of them respectively to the factory during the month.

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(1) See *R.* Feb. 1921, No. 210. (*Ed.*)

As regards the testing of milk which is to be paid for according to its fat-content, the authors lay great stress upon the fact that it is most important that the quantities sampled should be in proportion to the amounts of milk delivered ; a precaution usually omitted by Co-operative societies.

If all the milk supplied by a member could be collected and kept from one testing time to the next, it would fill a basin, but the flask only contains a certain proportion, and in order for this proportion to be equal, it is necessary that the sample taken every day should be proportionate to the amount of milk measured each day. If equal samples are taken the *average richness* differs greatly from the *resulting richness* according to the amounts of milk supplied, and its fat content at the different times the samples are taken ; and can be either higher or lower than the latter, a difference which gives rise to serious errors at the expense of either the producer or the cooperative society.

The individual *resulting richness* is the richness of all the milk supplied by a member if it were collected every day in a basin until the time of testting.

Calculation of individual error. — Supposing, that during a month of 30 days, a member has supplied N. litres of milk divided as follows :

On the 1st day, *A* litres giving *a* gm. in the GERBER apparatus (or *Aa* gm. of fat)
» 2nd » *B* » » *b* » » » » (or *Bb* » »)
. . . .
. . . .
. . . .
» 30th » *M* « » *m* » » » (or *Mm* » »)

If it were possible to collect all the milk, these N. litres would contain $\Sigma\, Aa$ gm. of fatty matter, and its fat content per litre would be :—

$R_1 = \frac{\Sigma\, Aa}{N}$; this being the resulting difference, whereas the average fat content would be :

$$r_1 = \frac{\Sigma a}{30}$$

The deviation in the fat content due to equal sample-taking is thus :

$R_1 - r_1$ or $\frac{\Sigma\, Aa}{N} - \frac{\Sigma a}{30}$, and the formula for the individual error is :

$$E_i = \frac{\Sigma\ [a\,(30\,A - N)]}{30.\ N}$$

which is cancelled, for $N = 30\,A = 30\,B = 30\,M$ or $A = B = M$ } that is to say, when the member supplies equal volumes every day.

The authors not only advocate that the price of milk should be based upon its fat content, but urge that a deduction ought be made in the case of all milk with an acid content varying from 25° Dormic to the degree at which natural curdling sets in, since it is only fair, that milk which has been carefully collected, kept, and dispatched, should fetch a higher price than an equally rich milk which contains impurities, for if it is acid, it entails loss upon the co-operative society. In order to assess this deduction, the authors suggest a method by which the excessive acidity A^0 measured at the factory can be divided under 3 heads: $A^0 = a^0 + t^0 + r^0$

a^0 = acidity of the milk when it leaves the farm. This is the fault of the member himself.

t^0 = acidity due to transit. The loss to be equally divided between the member and the factory.

r^0 = acidity due to retention in the dairy. The loss to be borne by the dairy-owner only.

II. — In England, milk is still usually bought by quantity, no account being taken of the quality of the product. The author remarks that this unjust method is disadvantageous to the producer, dairy-owner and consumer, but hits most hardly the producer who handles his milk with scrupulous cleanliness, and devotes care to the selection and proper feeding of his cows.

Although some cheese or butter-making establishments buy milk according to its fat-content, the general custom is to pay a fixed price per gallon of milk without considering its quality, provided that it contains not less than 3 % of fat and 8.5 % of solids not fat, these being the legal limits. The author gives a short account of the successive systems of buying milk that existed in Ireland before the price was regulated by the fat content, and states that none of them, even the most primitive, was so bad as that still practised in England.

Two systems of buying milk according to its fat content are adopted in Ireland: —

1) Each producer is paid according to the number of kg. of fad supplied during the month; this is determined by testing, and controllet by the actual results when the amount of butter obtained is known at the end of the month: the number of kg. of fat is calculated by multiplying the kilograms of milk by the average fat content obtained by testing; the product being divided by 100. As regards making the tests, the author mentions the great difficulties entailed by taking equal samples.

2) The average test-sample of the milk from each producer is taken every week, or every month. Each estimation is multiplied by the number of litres of the milk tested, and the product is then divided by the total number of litres of milk.

The owners of creameries are very partial to this method, which not only produces the largest quantity of cream, but economises time, power and labour. In all well-managed creameries, the milk is weighed on its arrival, in order to eliminate any factor that might interfere with the estimation of its true market value.

II — The authors endeavour to show that, if in most foreign butter-making countries the price of milk were based on its fat content this would appear to be an incomplete method of regulating the milk trade, for in addition to the fat content, the solids not fat should be taken into account, and also the freshness of the milk which depend upon special coefficients That is to say, the milk should be as fresh as possible, and be sufficiently rich in all its constituents for the following reasons —

Although payment based on fat content is relatively fair when the milk is to be made into butter it only serves to conceal fraud when whole, or nearly whole milk is to be made into cheese concentrated milk, milk powder, etc, in which case, not only the fat content but also the amount of solids not fat together with freshness of the milk must all be taken into consideration Payment according to fat content is especially unsatisfactory as regards the fat-free extract for as the authors observe the skimmed milk is regarded almost as a residuum which encourages watering the milk If the watered milk contains the amount of fat present in unadulterated milk it would fetch the same price as the latter and the purchasers therefore (the greater number of persons engaged in the dairy industry) would be greatly defrauded seeing that they would not have

	Fat content	Fat content	Butter yield	Calculated from the butter yield only at 12 4 mark per kg	Calculated from butter yield and milk yield			Difference	
					Receipts from butter at 8 5 marks per kg	Receipts from skim milk at 0 24 marks per kg	Total	plus	—
	kg	per cent	kg						
1	611	3 00	40	496 00	340 00	146 64	486 64	—	9 36
2	2 220	2 75	133	1 649 20	1 130 50	532 80	1 663 30	14 10	—
3	6 056	2 95	391	4 848 40	3 323 50	1 453 44	4 776 94	—	71 46
4	456	2 60	26	322 40	221 00	109 44	330 44	8 04	—
5	374	3 40	28	347 20	238 00	89 76	327 76	—	19 44
6	156	2 50	8	99 20	68 00	37 44	105 44	6 24	—
	93	3 15	6	74 40	51 00	22 32	73 32	1 08	—
	1 894	2 70	111	1 376 40	943 50	454 56	1 398 06	21 66	—
9	23	3 10	2	24 80	17 00	5 52	22 52	—	2 28
10	32	2 60	2	24 80	17 00	7 68	24 68	—	0 12

received all the fat-free extract to which they had a right. The economic effect of this measure upon the dairy industry would be considerable, as is shown by the following simple calculation.

If in the manufacture of concentrated milk, two milks are used having the same fat content per litre, but different amounts of solids not fat (80 gm. in the first case, and 95 gm. in the second), a saving of 1220 litres (or a gain of 11.1 %) would be obtained in making 1320 kg. of condensed milk, if milk No. 2 were used; further, there would be 13.8 % less water to be evaporated, and more sweetened natural milk could be produced than with sample No. 1.

IV. — RAUCH regards the question from the point of view of both producer and consumer, and shows the undesirableness of the incomplete estimation of milk by an extract from the account-book of a dairy (reproduced on p. 635) which brings out the injustice of payment according to butter-yield.

The calculation of the butter-yield is carried out by means of the tables compiled by HELM, HITTCHER and FORSTER, the skim milk being entirely left out of account.

AGRICULTURAL INDUSTRIES

555 - **Production and Utilisation of Maize Oil in the United States.** — SIEVERS, A. F. (Chemical Biologist, Drug, Poisonous and Oil Plant Investigation), in *United States Department of Agriculture Bulletin* No. 904, pp. 1-23, figs 11, Washington D. C., Oct. 29, 1920.

This bulletin deals chiefly with the production of maize oil from the germ of maize kernels. The two proceeds of degermination are given: the dry milling process, used for making hominy proesses such as grits, flakes, meal, flour and hominy feeds: the wet process used in the manufacture of starch, glucose and related products. The methods of degerminating differ materially in these 2 processes.

Details are given of:— the methods employed in the extraction, handling and disposing of the crude oil; the utilisation of maize oil; the effect of colour and condition of the maize on the yield and character of the oil; the economics of maize oil production.

The appended tables show:— The fat, moisture and free fatty-acid content of material produced in representative maize-products mills; the estimated cost of the process of production of maize oil; and the comparison of the revenue obtainable from the germs used for oil extraction. Tables I and II (p. 637) reproduce the more important data with reference to the above mentioned points.

The net revenue for extraction is estimated at 23.67 cents per bus. of maize (wet process) and 16.17 cents per bus. (dry process); the balance in favour of extraction against disposal for feeding stock amounts respectively (wet and dry processes) to 15.27 and 5.75 cents per bus.

In closing the author describes briefly the methods employed in the production of edible oil, and discusses future prospects. He considers that the amount of maize oil used for edible purposes in the future will be determined by the quantity available rather than by any question as to its utility. Maize oil is not always obtainable is sufficient quantities to meet the demands, and this has often led to the use instead of cotton-seed oil.

TABLE I. — *Composition of material produced by the wet and dry processes of degerminating maize.*

	Material analysed	Wet process (starch mills)	Dry process (hominy mills)
Free fatty acids	Crude oil	1.11	2.39
	Refined oil	(1) 0.10	(2) 0.13
Fat	Germs	17.88	42.23
	Oil cake	6.82	8.70
	Feed	5.92	4.38
Moisture	Germs	6.96	4.37
	Oil cake	5.81	7.74
	Feed	11.35	10.15

(1) A single analysis — (2) Average of 3 analyses

TABLE II. — *Oil left in oil cake when operating on wet and dry processes of degerminating maize.*

	Wet process	Dry process
Germs obtained from 1 bus of maize	4.17 lb.	3.47 lb.
Oil in germs	18.00 %	45.00 %
Oil left in cake	6.00 %	9.00 %
Oil obtained from 1 bus. of maize	0.532 ib.	1.372 lb.
Cake obtained	3.637 ib.	2.097 lb.
Oil in the cake	0.2182 ib.	0.1887 lb.

556 - **The Resistance of Vinegar-Eels to Different Agents.** — PASSERINI, N. (Director, of the Agricultural Institute at Scandicci), in *Le stazioni sperimentali agrarie italiane* Vol. LIV, Parts 1, 2, and 3, pp. 15-16, Bibliography of 22 works. Modena, 1921.

Vinegar-eel (*Anguillula aceti* Müller) very frequently occur in wine-vinegars, and PASTEUR has shown that they hinder acetification; according to the author, however, they do no appreciable harm to the vinegar, when once it is made. No cases of disturbance due to the presence of vinegar eels in the human digestive system have ever been recorded, although these organisms are sometimes found in the faeces, etc. As the presence of *Ang. aceti* is considered detrimental to vinegar, the author has tried to find some means of destroying these intruders, and has extended his researches to substances which, owing to their toxic character, cannot be used in industry. He summarises the results obtained on the same subject by other investigators, and describes his own work; some of his results are summarised as follows:—

Vinegar-eels are very resistant to many chemical substances, adult females being even less affected than the males and young individuals; further, they have the power of gradually adapting themselves to these agents. Their resistance varies much according to their origin, which explains the very various results obtained by different authors. Vinegar-eels can live for several days in vinegar containing:— 18 % actic acid 10 % tannic acid; 5 % tartaric acid, 16 % citric acid; 8 % lactric acid 45 % succinic acid. They can exist in contact with:— 1 % boric acid 2 % formic acid; 2 % pyrogallic acid. They are much more susceptible to mineral acids such as 5 per 1000 hydrochloric acid, 5 per 1000 nitric acid, and 1 per 1000 sulphuric acid, although they are able to resist even these for some time.

Sulphur dioxide, if introduced in large quantities, kills all the vinegar-eels in time. They can withstand 4 per 1000 carbolic acid, and 3 per 1000 salicylic acid; and are very resistant to the halogenes.

The most active metals are those most quickly attacked by vinegar.

The vinegar-eels live a long time in a 4 % solution of sodium chloride. and in more concentrated solutions of other metallic salts. In equal amounts, potassium salts are less active than sodium salts. A 1 per 1000 solution of chloride of mercury causes the death of these organisms in a few hours, and a solution of potassium cyanide kills them, but only after some days.

Anguillula aceti is extremely resistant to alkaloids.

In an atmosphere of oxygen and hydrogen, it lives at least 1 month; carbonic acid renders it motionless in 12 days, but without killing it. Many individuals die after 5 days in acetylene, whereas others can resist for over 15 days.

In distilled water, vinegar-eels die in a few days; they will, however, live for 1 month in spring water.

In 2 % in volume of 12 volume hydrogen peroxide some of the "eels" survived for 1 week, and even longer. The reagent which is most injurious to them is carbon bisulphide; the aqueous solution (at 1 per 1000) kills the "eels" very quickly if it is mixed with the vinegar in the proportion of 1 : 4 or more. If 0.5 per 1000 of mustard flower is added to the vinegar, the "eels" live for a fortnight, or even longer. A 5 % dose of Dalmatian pyrethrum (powdered flower-heads) was inactive for 1 ½ months.

Filtration is not a certain method of entirely freeing vinegar from "eels." At a temperature of 47.5° C. they all die, but in practice it is advisable to raise the temperature to 50° C. The prolonged action of cold (— 12° C.) destroys them, rapid thawing being more fatal than slow thawing.

Vinegar-eels die without heating, if the vinegar is exposed to sunlight for several hours. A rise of temperature much below the point that destroys them accelerates the action of the solar rays; the author has shown that ultra-violet rays are those which are most harmful. Exposing these "eels" to a Kromayer lamp and to a Schott and Gen apparatus for 13 hours had, however, an absolutely negative result; similarly no effect was produced by 1 hour's exposure to X rays, or by 24 hours' action of radium emanations (1 cgm. of bromide).

The exclusion of air, which would seem to be the easiest way of freeing vinegar from these parasites, is one of the least certain methods, for they can live for a long time at the expense of the small quantity of oxygen in solution in the vinegar. Even if all contact with the external air is excluded, the "eels" can survive for over a week. They can even live some days in vinegar that has been previously boiled and kept from contact with atmospheric air.

It takes a fortnight to kill them all in a barometric vacuum Olive-oil, or vaseline, placed on the surface of the oil has absolutely no effect, for the air can pass through the oily layer, or find its way between it and the walls of the vessel.

Drying the air kills vinegar-eels very rapidly; only in one case did the author find life not to be extinct.

557 – **Chinese Wax.** — see No 500 of this *Review*.

558 – **Studies on the Price of Milk.** — See No 554 of this *Review*.

559 – **Method for the Detection of Abnormal Milks.** — Baker, J. C., and Van Slyke, L. L., in *Technical Bulletin, No. 71. New York Agricultural Experiment Station*, pp. 1-14. Geneva, N. Y., June, 1919.

The method employed was based upon the use of brom-cresol purple as an indicator.

Clark and Lubs were the first to suggest the use of this indicator in connection with milk cultures. They made use of the dye then known as dibrom-ortho-cresol-sulfon-phthalein (*Journal of Agricultural Research*, Vol. 10, p. 105, 1917). This dye can be purchased from Hynson, Westcott and Dunning, Baltimore M. D.

One drop of a saturated water solution of this dye is mixed with 3 cc. of milk, and the colour is observed. Normal fresh milk gives a greyish-blue shade. The production of a darker or lighter colour awakens suspicion in regard to the normal character of the milk. The colour is made lighter by acids, acid salts, formaldehyde, and also by heating above the usual point of pasteurisation. The colour becomes deeper blue in the case of milk from diseased udders, watered milk, skimmed milk, and milk containing alkali or alkaline salts. In the inspection of milk, a sample is taken for further detailed examination in the laboratory. If the colour is sufficiently lighter or darker than normal it indicates the probability of some abnormal condition.

The method has been applied and 570 samples of market milk examined. Watered milk is thus easily detected, and also milk containing ex cessive numbers of leucocytes. A standard of colour can be prepared by which comparison can be made and conclusion more easily reached as to the normality or abnormality of samples examined.

560 - **Carbon Dioxide Content as a Basis for Distinguishing Heated from Unheated Milk.** — VAN SLYKE, L. L., and KEELLER, R. F., in *Technical Bulletin* No 78. *New York Agricultural Experiment Station*, pp. 1-7, Geneva N. Y., March 1920.

The object of this investigation was to ascertain whether the heating of milk under the pasteurisation conditions, changes the carbon dioxide content in such a way as to establish a means of knowing whether milk has been pasteurised or not. It has been found necessary, therefore, to study such other conditions as may affect the carbon dioxide content in the usual method of handling milk, from the time of milking to the time of delivery to the consumer.

Conclusions

1) The content is not appreciably affected by the method of milking.

2) The content rarely drops below 3 to 3.5 % by volume, when milk stands under ordinary conditions, even for periods of 20 to 40 houns after milking.

3) The content is not appreciably changed by passing through the separator, and only extreme and prolonged stirring reduces the carbon dioxide below 3 % by volume.

4) Heating milk under the conditions required for pasteurisation reduces the carbon dioxide content to, and usually below 2.5 % by volume.

Consequently, the authors consider that, when the percentage of carbon dioxide by volume is not more than 2.5 %, it is safe, in general, to assume that the milk has been heated to the temperature of pasteurisation.

561 - **Amount of Acidity and Coagulation in Fresh Milk.** — See No 471 of this *Review*.

562 - **Butter Hydrometer.** — BRUNO, A., in the *Annales des Falsifications et des Fraudes*, No 144-145, pp. 543-545. Paris, October, 1920.

The hydrometer devised by the author allows of the water content of a butter sample being estimated very accurately, in a few minutes, without the help of a laboratory.

Description. — The apparatus consists essentially of a stand, a float, and a lead weight The stand is graduated ana surmounted by a flat plate

The graduated scale consists of a scale of 20 divisions from 0 to 20; each division represents 1 gm of water per 100 gm. of butter. The densimeter is enclosed in a metal-case, which serves as a gauge, the inner cover consists of a small alcohol lamp. The apparatus is completed by an aluminium cup, a spatula and a pair of forceps.

Mode of operation. — This is very simple. The case is filled with pure water to within a few centimetres of the top. The hydrometer is immersed in the water, care being however taken that the plate remains dry.

About 5 gm. of the butter to be examined is taken up with the spatula and placed in the cup, which is put on the plate. Little pieces of butter are added, or removed, so as to bring the zero mark to the level of the water.

The cup is then removed, and held over the flame of the little lamp, in order to melt the butter completely The butter is further heated gradually, until it assumes a deep red colour. Then the cup is placed on the plate of the hydrometer. The observer then waits till the instrument has regained its equilibrium, and reads off the figure at the water level as before, thus obtaining the number of grammes of water per 100 grammes of butter.

563 - **Inoculation Experiments with a View to the Improvement in Flavour of Cheddar Cheese.** — See No. 471 of this *Review*.

564 - **Bacteriological and Chemical Investigations Concerning Silage.** — See No. 471 of this *Review*.

PLANT DISEASES

GENERAL INFORMATION

565 – **Decree of the President of the French Republic, of March 8, 1921, Prohibiting the Importation of Living Plants, Fruits and Seeds of the Chestnut, as a Guard Against *Endothia parasitica*** (1). — *Journal officiel de la République française* Year LIII, No 66, p 3076 Paris, March 11, 1921

Art I — Importation and transport into France of living plants, fruit and seeds of chestnuts coming directly or indirectly from the Far East is forbidden, including also countries which have not adopted preventive and control measures against the disease caused by the fungus *Endothia parasitica*.

Art II — In observance of the prohibition presented in Art. I, importation authorisations will be allowed by the Ministry of Agriculture on conditions fixed according to the advice of the Consultive Committee on epiphyte

566 – **The Imperial Bureau of Mycology.** — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No 2, pp 94-95. London, 1921.

The Imperial Bureau of Mycology is the outcome of a proposal unanimously adopted by the Imperial War Conference in 1918 that a central organisation should be established for the encouragement and co-ordination of work throughout the Empire on the diseases of plants caused by fungi, in relation to agriculture.

The headquarters are situated at Kew and have the advantage of proximity to a fine library and the collections of the Royal Botanic Gardens, with the Director and Staff of which the Bureau will work in co-operation.

Dr. E J. Butler, late Imperial Mycologist, Director of the Research Institute, Pusa, and Agricultural Advisor to the Government of India, has been appointed Director, The Committee of Management consists of some of the foremost biologists in the country.

The funds of the Bureau are entirely provided by contributions from the various self-governing Dominions, India, Egypt and the Soudan, and the non self-governing Colonies and Protectorates. It will work broadly on the lines of the existing Imperial Bureau of Entomology at South Kensington. It will be a central agency for the accumulation and distribution of information and for the identification of specimens sent in from all parts of the Empire. It is proposed to issue, as soon as funds permits a periodical journal through which those interested in mycological work in regard to agriculture will be kept informed of progress elsewhere.

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(1) See also *R* April 1921, No. 443 (*Ed*)

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

567 - **Fruit Fungi Observed in Belgium.** — MARCHAL EL. and MARCHAL, EM., in the *Bulletin de la Société royale de Botanique de Belgique*, Vol. LIV (New Series, Vol. IV), pp. 1-31, 2 pl. Brussels, 1921.

A contribution to the study of fungi that live on fruits in Belgium. The experiments, which were made from the purely mycological standpoint, were carried out during 1915-1920, in the district of Namur, in the neighbourhood of Gembloux, on succulent fruits, and especially stoned fruit, of which the late varieties, particularly if kept for some time, are subject to the attack of very varied parasites. Several thousand specimens were examined, 815 being made the object of special investigation and cultivated in different media.

This study of fruit-fungi has enabled the authors to identify 64 different kinds, among which there are 24 varieties or species hitherto unknown to science, a description in Latin being given, and 21 forms new to Belgium.

568 - **Observations on the Perfect Form of the Oak Oidium in Italy** (1). — PEYRONEL, B., in *Le Stazioni sperimentali agrarie italiane* Vol. LIV, Parts 1-3, pp. 5-10. Modena 1921.

On November 1, 1920, at a short distance from the last houses of Rome, the author found, on the leaves of shoots of *Quercus Robur* vars. *sessiliflora* and *pubescens* (= *lanuginosa*), which were thickly covered with the well known white patches produced by oidium, a large number of perithecia. These fructifications usually resembled small brown or nearly black spots; a few, which were, however, not fully ripe, were orange-coloured. The perithecia were present almost exclusively on the adult leaves, being very rare on the younger leaves of the top of the shoot, especially in the case of *Q. Robur* var. *sessiliflora*, whose leaves are more succulent. They occurred generally on the upper blade of the leaf, but when this had become withered through the attacks of the fungus in its conidial form, the perithecia were often found also on the lower surface

On the 5th of the following December, the author saw, at the distance of some kilometres from Rome, other leaves of *Quer. Robur* var. *pubescens* bearing quite ripe perithecia.

According to PEGLION, the formation of perithecia is due to abrupt falls in the temperature following periods when the thermometer has been rather high; this suggestion would appear to be confirmed by the meteorological data registered during October, 1920. The author, however, is of opinion that a rapid lowering of the temperature is only the indirect cause of perithecia formation, and that the real cause is the dryness. In speaking of dryness, it must be understood that the proportion between the superficial evaporation or transpiration of the fungus, and the amount of sap the latter can absorb from the host plant must be very high for the fungus to run any danger of perishing from want of moisture. As is well-known, cold arrests the physiological functions of a plant, and interferes to a special extent with the circulation of the sap; in the case in question, this effect was all the greater on account of the lateness of the season, and hence the plant was inclined to shed its leaves and enter into the winter resting-period. The effect of rapid falls in the temperature persists for some days after the cause has ceased. The periods of these abrupt changes were accompanied, even at night, with unusual dampness of the atmosphere, which reached its height between October 26 and 29.

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(1) See *R.*, February 1920, No, 264 (*Ed.*)

It is easy to understand that, given all the above-mentioned circumstances, which conspired to bring about the drying-up and death of the fungus, the latter was obliged to produce more resistant organs than the delicate mycelium and conidiophores. The author indeed believes that, in the Ascomycetes, perithecia instead of being a means of sexual reproduction — which is often non-existant or abortive in many of these fungi — are true organs for resisting unfavourable surrounding conditions, and drought in particular, for when the temperature is low, even the most delicate fungi suffer little, provided they are not growing in too dry a medium.

The author thinks that the perithecia found on *Q. Robur* var. *sessiliflora* and *pubescens* are to be attributed to *Microsphaera quercina* (Schw.) Burr.; whereas, on the other hand, those seen sporadically before 1907, on oaks in Portugal (*Oidium quercinum*, Thüm, on *Q. racemosa*, in Italy, (*Microsphaera* on *Quercus* sp.), and in Switzerland (*Microsphaera* on *Q. Robur* var. *pedunculata*) are to be regarded as belonging to *Micr. Alni* (D. C.) Wint.

If this view is accepted, the " oidium " of the oak must be regarded as a separate form, quite distinct from *O. quercinum* Thüm , to which, for reasons of priority, belongs the name of *O. gemmiparum* (Ferr. Pezr. (= *Q. quercinum* Thüm var. *gemmiparum* Ferr. *O. alphitoides* Griff and Maubl).

569 – **Varieties of Wheat, Barley and Alfalfa Resistant to Fungoid Diseases in Mahndorf, Germany.** — See No. 478 of this *Review*.

570 – **" Tabac bleu" in Mauritius, Resistant to Disease.** — See No. 504 of this *Review*.

571 – **" Sirah" Vine Resistant to Oidium and Mildew in Italy.** — See No. 512 of this *Review*.

572 - **The Pre-Soak Method of Seed Treatment: Means of Preventing Seed Injury Due to Chemical Disinfectants and of Increasing Germicidal Efficiency.** — BRAUN H., in *Journal of Agricultural Research*, Vol. XIX, No. 8, pp. 362-392, figs 9, tables 13, pl. 14, bibliogr. of 10 works. Washington D. C. July 15, 1920.

The use of disinfectants to prevent seed injury is generally attended by retarded seed germination. Pathogens on the seed coats, present in dry bacteria, fungus spores, or dormant mycelium, are usually in a resting stage, and as such, require the use of disinfectants in a fairly strong concentration :— 1 : 80 for copper sulphate, and 1 : 200 or 1 : 320 for formalin which often act very detrimentally on the germinating wheat seed. The use of lime after copper sulphate, while beneficial to a certain extent, does not entirely prevent seed injury, nor has the detrimental effect of formalin been up till now fully counteracted. The economic importance of the annual loss of grain due to seed treatment is such that, during the recent war, the War Emergency Board of the American Phytopathological Society conducted an elaborate series of tests of standard grain disinfectants.

In the course of investigations on the black chaff bacterial disease caused by *Bacterium translucens* var. *undulosum* (1) under the direction of Dr. E. F. SMITH a new and effective treatment was employed.

Greenhouse and field experiments here reported showed that this detrimental effect can be eliminated for standard varieties of wheat by allowing the seeds to absorb water for 6 hours before submitting them to the treatment with formalin or copper sulphate soaking for a period of 10 minutes and covering for 6 hours (here designated the pre-soak method). is better than leaving in water for 6 hours. Similar results were obtained in experiments with barley, oats and maize.

The saturation of the seed cells and cell walls with water during the pre-soak period appears to be the factor counteracting the injurious effect on seed germination by diluting the disinfectant beyond the point of injury as it diffuses into the tissues and also by considerably decreasing the amount which may penetrate into the tissues later. In addition to this, it tends to stimulate dormant bacteria and fungi into vegetative activity, thereby rendering them extremely susceptible to the subsequent action of the disinfectant.

Actual stimulation of germination has been observed repeatedly in pre-soak-treated seeds, a factor which minimises the danger of exposure to the attack of soil organisms during this susceptible period.

The bacterial blackchaff disease of wheat can be controlled without any injury to seed germination, by a 6 hour pre-soak of surface - infected seeds in water, followed by a 6-hour treatment with formalin 1 : 400.

In practice, wheat seeds after being screened, should be soaked in water for 10 minutes at about 6 a. m., drained, covered and set aside moist until noon, then soaked with formalin 1 : 400 for 10 minutes, drained, covered and set aside moist until 6 p. m., and then spread out to dry over night to be planted the next day.

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(1) See *R.* Oct.-Dec. 1919, No. 1268. (*Ed*)

It should be noted that this treatment increases the bulk of the dry grain about 25 %.

In applying this method to other kinds of seeds, the length of time for the 2 parts of the process *i. e.* the pre-soak period and the subsequent disinfectant treatment period, should be governed by the following factors: *a*) the rate of absorption of water by the seeds ; *b*) the susceptibility of the seeds and pathogens to the disinfectant , *c*) the respective periods necessary for the beginning of seed germination and of vegetative activity of the pathogens.

In no case should the pre-soak period be continued up to the time seed germination begins. The length of time necessary for the seeds to absorb about 30 % of their weight of water is suggested as the length of the pre-soak period when not conflicting with other factors involved.

573 – **Injury to Wheat Seed Resulting from Drying after Disinfection with Formaldehyde.** — HURD, A. M. (Office of Cereal Investigations, Bureau of Plant Industry, United States Department of Agriculture), in *Journal of Agricultural Research*, Vol XX, No. 3, pp. 209-243, tables 16, pl 6, bibliogr of 77 works. Washington, D. C, Nov 1, 1920.

The investigation of the post-treatment action of formaldehyde on seeds was begun in 1918 in the plant pathology laboratories of the University of California as a part of the cereal-smut eradication campaign conducted by the U. S. Dept. of Agriculture, and lasted over a period of 9 months. The seeds treated were left for 10 minutes in a 0.1 % solution of formaldehyde followed by a draining period of 10 minutes.

The outstanding fact shown by these experiments is that all the seed treated with formaldehyde solution and then dried by exposing to the air, was either killed or seriously injured after 3 to 6 days, while that treated at the same time and stored at the same temperatures, but kept damp by sealing in jars, was practically uninjured up to the time it was destroyed by moulds. No injury was caused by treating wheat with either a 0.1 % (1 : 40) or a 0.2 % (1 : 20) solution of formaldehyde, if the seed germinated immediately after treatment.

To detect the presence of formaldehyde on treated seed, TOLLEN'S (1) " silver mirror " aldehyde test was used. This injury to seed after drying is apparently due to a deposit of paraformaldehyde on the seed which forms as the formaldehyde solution evaporates. The former, being volatile is constantly breaking down into formaldehyde gas, and thus concentrated and within such close contact with the seed, penetrates slowly.

Humidity is evidently a determining-factor in seed injury during storage. There was no injury in an atmosphere containing 70 % humidity and above, when the seed was not attacked by moulds. A lower percentage encouraged injury, especially intermediate humidity contents, as it was found that seed stored in an absolutely dry chamber was almost uninjured. Temperature may also be an important factor, but its relation to the problem has not yet been determined. For the maximum seed injury as a result of drying after treatment with formaldehyde it is evident however that there should be an optimum atmospheric humidity to permit first, the formation of paraformaldehyde, and second, formaldehyde gas in the seed.

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(1) TOLLEN'S reagent is made by dissolving 3 gm silver nitrate in 30 gm water and 3 gm. sodium hydroxide in 30 gm water The silver oxide precipitate produced dissolved by adding ammonia (s. g., 0 923) (*Author's note*)

Aeration of the treated seed is advisable in order to hasten evaporation of paraformaldehyde, and the consequent escape of the gas from around the seed. It was found for example that barley was less susceptible to post-treatment injury when dried after soaking in a 0.1% solution (probably due to protection afforded by the glumes), but when stronger solutions were used the injury was very severe.

Seed dried for 1 hour by being thinly spread on towels in the laboratory and then sealed in bottles was uninjured after weeks of storage: but seed dried longer, although not injured by rapid drying was injured upon being sealed, probably because of the concentration of gas in the bottle as a result of decomposition of the paraformaldehyde on the seed. Treated seed dried from 5 to 24 hours was more severely damaged upon being sealed than when dried for a longer time.

Sorghums were found to be uninjured by either a 0.1% or a 0.2% solution of formaldehyde even after weeks of drying (probably due to protection by glumes or thick seed coats).

Dry storage injury can according to the author, be entirely avoided by simply washing the seed with water after treatment.

574 – ***Sclerotinia Minor* n. sp. Injurious to Lettuce, Celery and Other Crops in the United States.** — JAGGER, I. C., in *Journal of Agricultural Research*, Vol. XX. No. 4, pp. 331-334, pl. 1. Washington, D. C., Nov. 15, 1920.

SMITH recorded in 1900 the occurrence of a fungus similar to *Sclerotinia Libertiana* Fuckel, which, however, produced much smaller sclerotia, in green houses, Massachusetts, where it was causing destructive rot of lettuce. DUGGAR (1909) states that a similar fungus occurred on lettuce in the vicinity of both Boston and New York City It was collected in 1912 and again in 1914 at South Lima in Western New York, where it seemed to be well established and was causing considerable injury to lettuce grown on muck soil In 1914 it was collected also on lettuce in a greenhouse at Rochester. N. Y. In the autumn of 1919, the fungus was frequently noticed on celery and lettuce in the vicinity of Philadelphia. During the winter of 1919-1920, the author observed the fungus causing distinct damage in a single field of lettuce at Sanford (Florida).

The fungus causes a very rapid decay and collapse of growing lettuce plants. The disease produced is almost identical with that caused by *Sc. Libertiana*. A soft, watery decay may begin at any point on the plant, but usually on the lower leaves, which rest on the ground, or on the stem near the ground. The rot spreads very rapidly and usually the main stem and bases of the leaves are soon attacked. The result is a rather sudden collapse of the whole plant which is rapidly converted into a soft, watery mass. When the decayed mass is pulled apart, the spaces between and around the decayed leaves and stem are found to be filled with white wefts of mycelium, which in a few days are replaced by numerous small black sclerotia. General observations indicate that the fungus possibly causes a rather more rapid decay and collapse of plants than is caused by *Sc. Libertiana*. The wefts of white mycelium in decaying plants are less conspicuous and the sclerotia are much smaller and much more numerous than in plants attacked by *Sc. Libertiana.*

On several occasions, portions of culture media covered with mycelium of the fungus have been placed on growing lettuce plants. When moist conditions have followed the inoculation, characteristic rapid decay has invariably resulted. H. H. WHETZEL found that the fungus was capable of attacking a large number of different plants.

As a result of 10 years experimental investigation, the author concludes that the fungus in question may be considered as a distinct species of *Sc. Libertiana.* As it seems to agree with no species hitherto described it is designated by the name of *Sc. minor* n. sp.

575 - **Bacterial Disease of the *Richardia*, in England.** — BEWLEY, W. F. (Experimental Station, Cheshunt), in *The Gardener's Chronicle*, vol. LXIX, No. 1787, p. 152, London, Mar. 26, 1921.

A disease of the Richardia which is causing serious losses to commercial growers of this plant is being investigated. The first symptom of the disease is the arrested development of the aerial portions. This persists for some weeks and is followed by a yellowing and withering of the leaves. The adventitious roots are brown and watery, finally becoming merely empty tubes, and the rot spreads into the corm itself, where local soft rots occur around the base of the roots. Finally, in an advanced stage of the disease, the greater portion of the corm becomes rotten, leaving only a healthy portion at the base of the leaves. Frequently eelworms (*Anguillulidae*) and spring-tails (*Collembola*) are present, but they are only secondary, the primary cause of the disease being bacterial.

The casual organism has been isolated and shown to be pathogenic. It is a bacillus, but apparently not identical with *Bacillus aroideae* Townsend, described as producing a rot of the leaves and corms of the *Calla aethiopica* (= *R. africana*). It is, however, identical with an organism which has been under investigation for some months, and which rots tomato fruits, potato tubers, turnips and cabbage stalks. The disease may be transmitted in drainage water and cow dung. Heavy watering assists the progress of the disease, while dry treatment helps the plants to recover. Once the disease symptoms appear it in advisable to give water only in the form of overhead dampings, and all diseased plants should be isolated at once. Preliminary experiments indicate that successful control of the disease may be accomplished by removing the corms from the soil and treating them with formaldehyde solution, mercuric chloride or hot water.

576 - ***Gloeosporium Bombacis* n. sp. a Melanconia Injurious to the Ornamental Malvacea, *Bombax insigne*, in Brazil.** — PUTTEMANS, A., in the *Bulletin de la Société de Pathologie vegetale de France*, Vol. VII, Part 3, pp. 74-75. Paris, 1920.

In a nursery-garden situated in the neighbourhood of São Paolo (Brazil), five or six specimens of *Bombax insigne*, which were 1 to 2 metres high, were attacked almost simultaneously by a disease causing the death of all the green shoots.

There appeared on the cortex of the green shoots, large irregular patches of a light-brown colour, which subsequently changed to a darker brown. Then, some rounded or oval bodies of a lighter shade and from 8-10 mm. in diameter developed at certain points; these soon proved to be the acervoli of a species of *Gloeosporium*, which the author regards as new to science, and has described under the name of *Gl. Bombacis*.

Later, the cortex of the plant became whitish and of an almost horny consistency; subsequently, some new shoots grew out of the lignified part of the stem which had remained healthy, a ring of wound callus having been formed.

These fresh shoots were in turn attacked by the parasite. The young plants would certainly have perished, had they not been carefully sprayed with Bordeaux mixture. It is also possible that the change which took place in the meteorological conditions helped to arrest the disease, which destroyed 10 % of the specimens it attacked, but has not again made its appearance.

577 - **The Effect of the Polyporea, *Fomes fulvus* on the Almond Tree in Italy.** — RIVERA, V., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 1-3, pp. 114-118. Modena, 1921.

In the province of Aquila in the Abruzzi, old almond trees are often found to be attacked by *Fomes fulvus* (Scop.) Fries. The fungus is easily recognised by its conspicuous fructifications, which generally grow on the outside of the branches, and usually very near the points of pruning. Most of the trees that harbour the parasite appear withered; the branches on which the fructifications appear dry up first and, as a general rule, the whole tree soon afterwards dies. The wood shows signs of alterations that are often of a serious character, and are either limited to special zones, or extend over large areas affecting the cambium, parenchyma, vessels, fibres, and the cells of the medullary rays. In the first stage, these tissues turn black and later on, are replaced by a yellowish-white substance. The alteration of the wood proceeds from above downwards, and is most advanced in the portion of the branch bearing the fructifications of the parasite, and least in the parts at the greatest distance from it. In cases of serious infection, the wood is altered to such an extent, that its loss of weight and consistency renders it of little use, not only for timber, but even for fuel.

The mycelium of *F. fulvus* sometimes grows to an extraordinary extent, forming in the cambium zone, a thick continuous felt-like layer, easily detached from the wood.

Occasionally the fructifications of the fungus are absent. This happens in the less serious cases; if the tree is cut, only one or more inter-radial zones are affected, and usually the disease is limited to one branch, or part of the trunk; in such a case, the fungus lives at the expense of its own mycelium. According to observations ranging over a considerable time, the author thinks that he can affirm that the development of the mycelium in the host plant usually continues for some years, the fructifications only being formed when the tree is about to wither, and a difficult period is beginning for the parasite owing to the exhaustion or serious affection of its host.

There is another case in which the fungus brings about the death of the tree in a less direct, but no less inevitable manner. Sometimes almond-trees are uprooted because they are seriously infected by the fungus, or have died from its attacks, in which case, young trees are planted in their place, or within a radius of from 6-10 m., in order to fill up the gaps, and seem to do well for a variable number of years, when suddenly, without any symptom of disease, they die. As no mycelium is found on the roots of young trees succumbing in this manner, it can only be supposed that their death is due to some more or less toxic substance, which is not easily dissipated through the soil, and is produced by chemical changes taking place in the old, dead, and perhaps rotten roots, or else to substances produced either by the fungus or its host and which have remained in the soil during the life-time of the diseased tree.

As to the origin of the malady, and the way in which the fungus passes from tree to tree, it must be remembered that rows of almonds are regularly destroyed. This would seem, at first sight, to argue that the fungus finds entrance by way of the roots, but the long series of observations made by the author has provided another explanation of the phenomenon in question. As a matter of fact, the lower parts of the trees, and especially the roots, are the portions least affected, for the top of the tree suffers most from the parasite, the portion nearest to the fruits being chiefly selected for attack; hence this is the earliest seat of infection.

If it is also remembered that the fruits are the point of attack, and that almond-trees are generally pruned in rows, it can easily be seen that pruning operations are the most general means of spreading the disease, and of introducing the fungus into the tissues of its host.

The pruner with his infected knife passing from tree to tree actually inoculates healthy individuals with the disease. From the point of section, the mycelium would spread through the living culture medium provided by the tree itself, and would continue increasing for several years, only producing fructifications when its dying host rendered its existence precarious.

When once the almond-trees begin to wither owing to the attacks of the fungus, little can be done to save them.

An efficacious method of preventing the spread of the disease would, however, be to persuade the grafter to sterilise his knife either chemically, or by means of heat; in this way, the infection could not be conveyed during pruning operations.

WEEDS AND PARASITIC FLOWERING PLANTS

578 – **Common Weed Seeds Found Amongst Alfalfa Seed in New South Wales.** — See No. 493 of this *Review*.

579 – **Weed Control Measures in Canada.** — CUMMING, M., BRADT, E. P., ROY, L. P., HOWITT, J. E., and MCCAIG, J., in *The Agricultural Gazette of Canada*, Vol. VII, No. 6, pp. 484-488, figs 6. Ottawa, June 1920.

Report of the latest measures taken in the control of weeds by the municipal councils in conjunction with experimental work in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario and Alberta.

Co-operative experiments in weed eradication have been conducted during the past 8 years with the Ontario Agricultural College. The results obtained permit the following conclusions:

1) Good cultivation, followed by rape sown in drills provides a means of eradicating both Perennial Sow Thistle (*Sonchus oleraceus*) and Twitch Grass (*Agropyron repens*).

2) Rape is a more satisfactory crop to use in the destruction of *A. repens* than buckwheat, and will act as a destructive agent to both *A. repens* and *S. oleraceus* to a greater degree when sown in drills and cultivated than when sown broadcast.

3) Thorough deep cultivation in the autumn and spring, followed by a well cared for hoed crop will destroy Bladder Campion (*Silene inflata*).

4) Wild mustard may be prevented from seeding in oats, wheat or barley by spraying with a 20 % solution of iron sulphate, without any serious injury to the standing crop or to a fresh crop of clover.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

580 – **Foreign Coleoptera Observed in Latium.** — LUIGIONI, P., in the *Atti della Pontificia Accademia Romana dei Nuovi Lincei*, 1 pp Rome, December 19, 1920.

In order to control the scale-insects *Diaspis pentagona* and *Aonidiella aurantii*, Prof. F. SILVESTRI liberated, in Rome, in 1910, several specimens of *Rhizobius lophantae*, an Australian coccinellid, which is a natural enemy of the two above-mentioned pests. No-one, however, has observed whether *Rhizobius* has become acclimatised and has increased in numbers. Beween the end of October and the end of November, 1920, the coccinellid was found in large numbers in a garden near Rome, but only on the leaves of the ivy and geranium.

The curculionid *Pantomorus* (*Aramigus*) *fulleri*, which is possibly a native of the United States or of Mexico, does injury to citrus trees and a number of other plants. The author found, early in October, 1916, two specimens of this insect in a garden in Rome, where it seemed so far to have done but little harm. Many other specimens of *Pant. fulleri* were discovered in October, 1920, in a garden on the outskirts of the same city.

Spermophagus subfasciatus (fam. *Bruchidae*), which was introduced accidentally with some beans from Brazil (1) was found, in 1917, in Sicily

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(1) See *R.*, May 1918, No. 605. (*Ed.*)

(near Messina), and also repeatedly on the walls of houses in the centre of Rome ; it was also collected in summer in fields in the vicinity of the city

Coccotrypes dactyliperda, a native of Africa and of the East Indies, where it lives as a parasite on *Phoenix dactylifera, Areca Catechu*, and *Hyphaene thebaica*, has been found in many parts of Italy (in the Trentino it is said to attack the olives) and has also been met with occasionally in Rome, on the city walls. It has also been caught on the wing, at dusk, in villas in the suburbs of the town.

581 - **Fruit Flies Introduced into Egypt.** — ADAIR, E. W., in *The Agricultural Journal of Egypt*, Vol. X, pp. 18-20. Cairo, 1920.

The existence of 4 species of fruit flies. (Diptera, Fam. *Trypaneidae* syn. *Trypetidae*) has been reported in Egypt :—

1) *Ceratitis capitata.* Wied., on oranges, guavas, peaches, etc.

2) *Dacus longistylus* Wied., in *Calotropis procera.*

3) Undetermined species, collected from fruits of *Zizyphus Spina-Christi* coming from Assiout.

4) Undetermined species, collected from *Carthamus tinctorius*, coming from Ibrim in Lower Nubia ; this Dipteron probably attacks the terminal inflorescences.

Three other species have been obtained from imported fruit. None of these appeared to have existed in the country previously and as they are all very injurious, precautions should be taken to avoid their spread.

1) *Chaetodacus zonatus* Saund : a specimen of this dipteron has been collected from a damaged mango confiscated at Port Said.

2) *Dacus oleae* Gm. obtained from green olives sent from Cyprus to Alexandria; the sample was received October 30, 1916 and an adult emerged on January 20 the following year.

3) *Rhagoletis (Carpomyia) pardalina* Big., attacks Curcurbitaceae.

582 - ***Degeeria collaris*, a Dipteron Reported as a new Parasite of *Galerucella luteola* in Italy.** — THOMPSON, W. R., in the *Bulletin de la Société entomologique de France*, Year 1920, No. 10, pp. 180-184, 1 fig, 1 pl. Paris, 1920.

From adult specimens of the elm Galerucella (*Gal. luteola* Müll) collected in the spring at Bevagna, in Umbria, the author bred, at the end of May, 1917, numerous specimens of *Erynnia nitida* R. D. as well as a tachnid dipteron already known as an endophagous parasite of the larva and adult forms of the elm Galerucella, and also some individuals of a tachnid which was determined as *Degeeria collaris* Fall.

It is probable that the larvae of *D. collaris*, like those of *E. nitida*, over-winter in the body of their host. The larvae of the latter insect pupate in the remains of *G. luteola*, but those of *D. collaris* leave their host when they reach maturity and pupate in the open.

The article contains detailed morphological information respecting this new parasite of the elm Galerucella.

583 - **The Golden Backed Woodpecker (*Brachypternus aurantius*), Bird Useful in Agriculture on India.** — FLETCHER, T. B., and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XV, Pt. 5, pp. 481-484, pl. 1 (col.). Calcutta, Nov. 1920.

The Golden backed woodpecker (*Brachypternus aurantius*) is common in India and Ceylon.

Ants appear to constitute a large part of its normal daily food, which consists almost entirely of insects; in addition to the ants, it feeds also on numerous small beetles, caterpillars and bugs, and occasionally on buds and fruits.

An examination of the stomachs of 16 birds captured at Pusa showed 3921 insects of which the great majority were ants, and it is notable that only one of these 16 birds was found to contain any longicorn beetle larvae, although observation renders it certain that this bird does feed to some extent on wood boring insects. In Eastern Bengal it is stated to feed on the larvae and pupae of *Hoplocerambyx spinicornis*, a longicorn borer pest of sal (*Shorea robusta*), and in Madras it is stated to be very partial to toddy-palms, which may be due to the fact that these trees are infested by *Oryctes rhinoceros* and *Rhynchophorus ferrugineus*. At Pusa many of the dead branches of *Dalbergia Sissoo*, tapped by this woodpecker, are infected with the termite *Coptotermes heimi* which probably provides a certain amount of nourishment to the bird.

Although not much is yet known of *B. aurantius* from the biological aspect, it is only right to include it amongst the useful birds from the agricultural standpoint.

In Bengal, Burma, Madras, Bombay and Assam, this bird is protected by law throughout the whole year.

584 - **"Tanglefoot," a Means of Controlling *Operophthera* (*Cheimatobia*) *brumata* and *Hibernia defoliaria*, Macrolepidoptera Injurious to Fruit Trees in France.** — PAILLOT, A., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VII, No. 10, pp. 274-277. Paris, 1921.

In the Rhone Valley, as in many other parts of France, the caterpillars of *Oparophthera* (*Cheimatobia*) *brumata* do great injury to the fruit trees. A method of controlling these pests which has long been adopted in the valley, consists in placing round the trunk, at a man's height, a band of viscous substance which prevents the wingless females from ascending the tree for the purpose of laying their eggs. Most of the mixtures used have a tar basis, and have the defect of drying too rapidly; further, they are harmful to the trees, and so cannot be directly applied to the cortex of the plants requiring protection.

Since November, 1918, the Entomological Station of Saint-Genis-Laval (department of the Rhône) has been making experiments with an American speciality known as "Tanglefoot," which is widely used in the United States. The first trial of this viscous mixture was carried out by applying it to the trees of the Station garden, which had all been injured to some extent in the spring by the caterpillars of *Op. brumata*, and also by the larvae of *Hibernia defoliaria*. "Tanglefoot," being innocuous to the tree, can be directly applied to the cortex, which greatly simplifies the operation, by means of a wooden spatula; the layer must be sufficiently thick, and the width of the band should be about a hands-breadth. It is reckoned that a vessel containing 1 kg. is sufficient for the protection of twenty tree-trunks of average girth. The trees upon which the experiments were made remained quite immune from the attacks of *Op. brumata*, not only for the next year, but also for two subsequent years.

With a view to determining the real value of "Tanglefoot", a large number of experiments were carried out against *Op. brumata* and *Hib defoliaria* in 1920, in the Departments of the Rhône and of the Drôme, as well as in the northern part of the Department of the ardiche. The results proved that "Tanglefoot" is the most perfect viscous mixture at present known. Its use should be encouraged and popularised in all districts where much injury is wrought by *Op. brumata* and *Hib. defoliaria.*

In every case, not only the females but also males of both macrolepidoptera were captured by means of the viscous bands; the proportion of males being always very large, although they are provided with normal wings

"Tanglefoot" might be purchased by a Cooperative Society formed for the purpose, or by syndicates or other agricultural organisations. In the latter case, it would be necessary to make joint purchases, in order to reduce the cost of carriage and insurance. The question of direct State assistance in the form of exemption from Customs Duties might also be taken into consideration.

585 - ***Pyrausta nubilalis*, Microlepidopteron Injurious to Maize, and *Stilpnotia salicis*, Microlepidopteron Injurious to Poplar Trees Two new Insect Pests Recenty found in Canada.** — Mc Laine, L. S., (Division of Foreign Pests Suppression, in *The Agricultural Gazette of Canada*, Vol. 7, No 10, pp. 793-794. Ottawa Oct 1920)

On August 10, 1920 at Lorraine Station, Welland County (Southern Ontario), some suspicious looking larvae were found infesting maize. The caterpillars were small and the amount of damage done was light. Searches were made eastward and along the shore of Lake Erie and it was noticed that the intensity of attack increased until it was finally centred in the vicinity of Ridgeway and Crystal Beach. Specimens were identified as the European maize borer, *Pyrausta nubilalis* Hubn (1). According to the latest reports the infested area extends from Fort Erie on the east to Dunnville on the west along the Lake Erie shore, and about 20 miles inland On August 23, samples of caterpillars also proving to be *P. nubilalis*, were reported on the maize in the vicinity of St. Thomas; 5 % of the plants in the fields examined were found attacked by the pest. Judging from the search work results up to September 5, this second (St. Thomas) outbreak was more intensive and widespread than the first, and extended from Straffordville (Elgin County) on the east to Rodney on the west, and Strathroy on the north.

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(1) See *R.*, Oct.-Dec. 1919, No. 1289; *R.* Apr. 1920, No. 474. (*Ed.*)

[584-585]

In the latter part of July, 1920, an outbreak of caterpillars was noticed in New Westminster B C. A collection was made, the moths reared and adults of the satin moth (*Stilpnotia salicis* L.) were obtained (a pest already well known in Europe and Asia which often severely attacks poplars and willows). The first record on the American Continent was, made in the spring of 1920, when it was discovered in the vicinity of Boston (Massachusetts).

586 - **The Bean Weevil (*Acanthoscelides obtectus*) in Austria** (1) — TSCHERMAK, E, in the *Wiener Landwirtschaftliche Zeitung*, Year LXXI, No. 17, pp 102, 6 figs. Vienna, February 26, 1921.

The presence of *Bruchidius obtectus* (= *Acanthoscelides obtectus*) was observed for the first time at Vienna by the author in 1918, when he only found three beans attacked by the insect

In 1919, the weevils were somewhat more numerous, but still only a few seeds were affected. In 1920, the bean-crops were infected by these pests, the attack being quite unexpected. Beans in the neighbourood of Vienna suffered in the same way, especially the white varieties, the coloured varieties being less attacked.

The author mentions the control measures usually adopted against this coleopteron.

587 - ***Pectinophora gossypiella*, Microlepidopteron Injurious to Cotton in Montserrat and St. Kitts, West Indies** (2) — *The Board of Trade Journal and Commercial Gazette*, Vol CVI, (New Series), No. 1266, pp 239-240 London, March 3, 1922.

The Pink Boll worm (*Gelechia gossypiella* = *Pectinophora gossypiella*) was found in cotton plantations on November 5, 1920, in Montserrat, and on November 15, in St. Kitts. These are the first recorded occurrences of this pest in the West Indies.

Investigations proved that the pink boll worm has not been found in Antigua and Nevis; in Montserrat and St. Kitts, it is, however, now well established. The distribution has followed very much the same lines on each of these islands. Apparently introduced at or near the port, the insect has spread considerably to the north along the western coast; it has spread but little to the south and east.

Only one theory so far appears to furnish an explanation of this invasion. This concerns a steam-ship coming from Brazil and having a cargo of Brazilian cotton and cotton seed (this has not been fully authenticated). During the first fortnight of June 1920, the ports visited were in Montserrat, St. Kitts and Antigua. Just at this time there would have been cotton growing near the sea in a suitable condition for pink bollworm attack, these coming from the caterpillars in the seed in the ship's hold. At Antigua, however, there would only have been a small amount of cotton near the anchorage, and that was old cotton, which was being destroyed at that time. The new crop was not planted in that part of Antigua until August.

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(1) See *R.* May, 1918, Nos. 605 and 606. (*Ed.*).

(2) See *R.* March 1919, No. 405. (*Ed.*)

Allowing about 4 ½ to 5 weeks for each generation of *Pect. gossypiella*, there would have been time for the development of some four or five generations of pink bollworm from the time of its introduction in June until its discovery in November.

The spread has been almost entirely with the wind or across its prevailing direction, and very little against it.

Several measures of control have been suggested and the advisable precautions which should be taken in districts so far unattacked.

588 - **Studies on the Life-History and Habits of *Eutettix tenella*, the Beet Leafhopper, in Idaho and California.**— STAHL, C. F., in *Journal of Agricultural Research*, Vol- XX, No. 4, pp. 245-252, pl. 2, bibliogr. of 7 publications. Washington D. C. 1920.

Summary of observations bearing on the life history and habits of the beet *Eutettix tenella* Baker (Fam. Jassidae) made during the past few years at Jerome, Idaho, and in the sugar beet growing regions of California.

A description is given of the egg, nymph and adult stages; there is little difficulty in distingiushing the beet leafhopper from certain species of *Agallia* and *Cicadula* 6-*notata* Fallen, although there is a distinct resemblance between *E. tenella* and these species.

E. tenella deposits its eggs on various plants (*Salsola Kali* var. *tenuifolia*, *Erodium cicutarium* and *E. moschatum*, *Chenopodium* spp. and *Atriplex* spp.); it, however, apparently gives preference to the sugar beet. The maximum number of eggs deposited by one female alone was 247. The incubation period ranges from 10 to 15 days, and the nymphal period from 25 to 52 days.

There was only one brood in Southern Idaho, but in California two and even four generations have been notified.

In Southern Idaho the earliest record of the leafhopper in the cultivated sugar beet fields was in June; oviposition begins as soon as the adults appear and continues throughout the season. After the crop is finished, the hibernation period commences.

In California, the leafhoppers first appear in the spring, about April 1, and continue until cropping time; attention is directed chiefly towards wild vegetation. There is no true hibernation in the districts of California under observation.

The following three species of egg parasites have been reared and studied (given in order of importance): *Polynema eutettixi* Girault, *Abbella subflava* Girault, and *Anagrus giraulti* Crawford. As parasites of the nymphs and adults two species have been reared *viz. Pipunculus industrius* Knab., and *P. vagabundus* Knab; and the first of these was quite effective. Dryinid parasites, also were reared but are considered of negligible importance from the economic standpoints.

589 - **Enemies of the Edible Date in India.** — See No. 507 of this *Review*.

590 - ***Hemerocampa pseudotsugata*, New British Columbia Tussock Moth Injurious to Douglas Fir (*Pseudotsuga Douglasii*), in British Columbia.** — Mc DUNNOUGH, J, in *The Canadian Entomologist*, Vol. LIII, No. 3, pp 53-56. London, March, 1921.

A macrolepidopteron determined by E. H. BLACKMORE (1918) as *Hemerocampa vetusta gulosa* Hy. Edw. has been reported during the past few years, as damaging the Douglas fir (*Pseudotsuga Douglasii*) in certain districts of British Columbia.

A number of eggs of the species was collected in the spring of 1920 at Chase, B. C. and from these a limited number of adults were obtained at Ottawa. These were fed until half grown on hemlock (*Tsuga canadensis*) and were then transferred to *Ps. Douglasii*. The moths emerged in the first week of July, an earlier date than that given by BLACKMORE.

After close observation of the different stages of development of the macrolepidopteron in question, the author was led to consider this a new species which he described in detail under the name of *Hem. pseudotsugata.*

591 - ***Pissodes notatus*, Coleopteron Injurious to Pines in Uruguay.** — TRUJILLO PELUFFO A, in *La Propaganda Rural*, Yr. XIX, No. 410, pp. 2. Montevideo, 1920.

In various pine forests along the coast of Maldonado (Uruguay), a small insect has been notified which has caused damage to young plantations leading to the loss of thousands of trees. Although the plantations suffered considerably, groups of five or six trees were left standing.

A visit to the district, made on September 4, 1920, resulted in observations giving evidence of the fact that on the trunks of several pines showing signs of obvious injury or already dried up, were certain larvae. These, on transportation to the laboratory for breeding purposes, changed to nymphs (the first were observed on September 18) and later (October 6) to perfect insects, which proved to be the Curculionidae *Pissodes notatus*.

On a second visit made on October 9, the insect was found again in the nymph stage in other pine forests.

It seems probable that the Coleopteron in Uruguay produces two generations per year

As a means of control, it is recommended to root up all the wasted trees and those on the verge of wasting as the coleopteron shows a marked preference for trees already weakened for other reasons. When a plantation has been attacked by this insect, it is advisable to carry the uprooted trees to a selected spot, and construct a fire in such a manner as to thoroughly burn the bark and destroy the parasites which are hidden therein. Trunks thus treated may be used afterwards for various purposes.

[590-591]

ALFREDO RUGGERI, *gerente responsabile.*

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART
ORIGINAL ARTICLES

The Agricultural Institute of Algeria

By M BRUNEL

Director General of Agriculture, Commerce and Colonisation, Algeria

(*Communicated by* M LOUIS-DOP, *Delegate for Algeria, Vice President of the Institute*).

At a time when everyone recognises the prime importance of intensifying agricultural production by rational improvement of the soil, with the object of re-establishing economic equilibrium in the world, and, consequently, the necessity of extensive technical instruction for agriculturists, especially those in the Colonies, the *Agricultural Institute of Algeria* merits especial notice.

This Institute originated in the conversion, unanimously asked for by the Algerian Assemblies in the Session of October, 1920, of the institution founded in 1905 at Maison-Carrée (Algiers) under the title of "École d'Agriculture algérienne"

It seemed indeed that the new name was more suited to the functions of the institution as it had to deal with both teaching, agricultural experiments, and the diffusing of agricultural knowledge. It perpetuates, at the same time, the progress made by the institution since it reopened after the war, in October, 1919, and the standard of the education there given

Regarding the progress made by the School itself it suffices, so as to show its importance, to record that it had 211 pupils on its books from 1905 to 1914, an annual average of 23, whereas in 1919 and 1920 there were 152, or 76 pupils in each year. It should further be noted that in that number, besides 65 pupils of Algerian origin, there was an almost equal number — 64 — of young men from the mother country as well as 23 foreign students (Swiss, Italian, Greek, Russian, Syrian, etc.).

By its situation, equipment and organisation, and thanks to the staff of distinguished scientists and technicians which it has been possible to provide, the Institute in question ranks indisputably among professional agricultural institutions of the first class.

The following description of the principal characteristics of the Institute will be of interest:—

AIMS. — The Agricultural Institute of Algeria provides the theoretical and practical instruction necessary for the scientific working and management of a country estate or an agricultural industry in North Africa, or in other countries in the Mediterranean basin; it also trains the pupils for settling in distant possessions. It appeals especially to young men from Algeria, France, or other countries, who, either on their own account or in the employment of others, wish to engage in agriculture in Algeria or in the neighbouring protectorates.

It is quite equally suitable for those who may have to practice husbandry in regions with a climate similar to that of North Africa, regions which occupy, as is well known, immense areas in various parts of the world. Greece and the other Balkan States, Syria, Egypt and Turkey, in particular, have every interest in sending students in increasing numbers. To these regions, so prosperous and populous in olden times, called to a brilliant renaissance thanks to Latin genius and modern science, this institution is a means of providing the expert young agriculturists which will be so greatly needed

Its very wide curriculum makes it moreover a real school of general colonisation. To young men who have passed out of Schools of Agriculture in France or in foreign countries and who wish to familiarise themselves with the special conditions of North African agriculture, to those who being no longer of an age and, though lacking the time for complete study, are, however, desirous of passing a period in a new environment, the Agricultural Institute at Maison Carrée provides the means of getting in touch with the country in conditions and an environment which are rarely to be found in a private farm.

SITUATION. MEANS OF STUDY. EQUIPMENT. ANNEXES. — Placed on the plateau which dominates the town of Maison-Carrée (12 000 inhabitants), 2 km. from the sea, in excellent conditions of hygiene and salubrity, the Agricultural Institute is situated only twenty minutes from the centre of the town of Algiers, at the opening of the rich plain of the Mitidja, at the junction of the railways which leaving Algiers lead, to the West, towards Oran and Morocco, and to the east towards Constantine and Tunis. It thus occupies the centre of that North Africa, so fortunately placed, of which Algeria will continue to be the jewel Near the Institute are situated important estates provided with the most up-to-date equipment, the celebrated vineyards of the Mitidja plain and the hills of Sahel, extensive nurseries of American plants, the magnificent orange gardens of Blida and Boufarik, the celebrated Chasselas vines ot Guyotville. In the neighbourhood there are also many factories that are closely connected with agriculture, notably large flour mills, chemical and fertiliser factories, distilleries, a large brewery, a sulphur refinery, brick-fields and potteries, to which have been quite recently added a wool cleaning factory and a very important cold store capable of dealing with more than 2500 sheep a day.

Taking into consideration the close proximity of the town of Algiers with its immense intellectual and scientific resources (University, Pasteur-Institute, Museums, Libraries and Laboratories of all kinds, Agricultural and Geographical Societies, College of Commerce and Hydrography, commercial and industrial courses, etc.); adding that the pupils of the Institute at Maison-Carrée can imbibe numerous lessons in the great North-African port situated in the centre of the great Mediterranean route at equal distances from Gibraltar, Malta, and Marseilles, from the Suez Canal and Northern Europe, port of call for the numerous shipping companies which serve the Levant and the Far-East, which became before the war the second largest French port in tonnage and for whose enlargement an expenditure of 200 000 000 francs has just been provided, it can not but be recognised that the environment could not have been better chosen for the training of well informed cultivators.

The material equipment of the Institute is not a whit behind its situation. It has all the premises and arrangements required for internal students and is equipped with the latest hygienic improvements. Sixty boarders can be comfortably housed. In addition, the Management is anxious to build a " Maison de famille " to which would be admitted, under similar conditions to those of the boarding house of the Institute, such day students as desired admission.

The facilities for study available at the Institute are considerable and perfectly adapted to the required ends.

The teaching given at the Institute closely resembles that of the French National Agricultural Schools or of foreign higher-grade institutions for agricultural teaching, but of course it is specially adapted to the special conditions in view of which it was founded.

There are 29 professorships held by 17 professors or assistant professors on the permanent staff of the Institute, all well-known specialists; and there are 12 professors on the external staff, professors at the University of Algiers or members of the Management. Applied and practical work is ensured by 6 " chefs de travaux " under the direction of the competent professor. The professors are provided with laboratories where the pupils are trained in research and manipulation: — Laboratories of Chemistry and Oenology, of Physics and Technology, of Agricultural Geology, Mineralogy and Chemistry, of Botany and Plant Pathology, of Agriculture, of Seed-Testing, of Viticulture, of Agricultural Zoology, of Zootechnology, furnished with varied collections of material required for analyses and micrography and also photographic studies.

There is also a meteorological Station at the Institute and, assisted by the Laboratory of Botany and Plant Pathology, it will serve as a basis for the organisation of a service of agricultural weather-forecasting. Special mention should be made of the teaching of Farm Engineering each of the various branches of which (Agricultural Machinery, Hydraulics, and Farm Buildings, Electrotechnology, Surveying and Levelling) is taught by a special professor.

The material means of study on which this teaching is based includes: A Laboratory of Agricultural Machinery with rooms for testing engines and machinery and an exhibition hall 600 sq. m. in area; very extensive work shops where the pupils are trained to make repairs and work iron and wood; and the equipment required for the Professorships of Mechanics, Electrotechnology, Hydraulics and Farm Buildings which are arranged in the adjacent premises.

The whole building, which has just been finished, constitutes a very important Station of Farm Engineering to which are attached, in addition to the four professors already mentioned, assistant and working instructors (these latter for the necessary manual labour).

The increase in mechanical tillage has led the Institute to add an Apprenticeship School for Farm Mechanics, and to establish a Practical Centre of Mechanical Tillage at its estate at Berteaux (see below) with the object of accustoming its pupils to the handling and driving of power-farming machinery over large areas

Besides the lecture rooms and three amphitheatres (one of which can hold 300 pupils), the Institute has at its disposal, for teaching, purposes, extensive Libraries which receive a very large number of agricultural and scientific journals and publications.

The pupils of the Institute are familiarised with all forms of agricultural work on 3 estates of a total area of over 500 hectares which the Institute owns, 80 hectares at Maison-Carrée, with vines, fodder crops, market garden, botanic garden; 15 hectares at Rouiba, with experimental vineyard, and orange garden; 425 hectares on the high plateaux of the Department of Constantine at Berteaux:— farming on a large scale, dry-farming, breeding, power farming).

ORGANISATION OF STUDY AND INSTRUCTION. — The Agricultural Institute of Algeria has adopted a curriculum which permits of complete instruction being given to its pupils in two years

The pupils enter for the first year's course at Maison-Carrée on October 1. The course commences with the revision (with essential complementary instruction) of subjects, the knowledge of which is essential for understanding the technical courses, and by a rapid study of generalities (physics, history, politics and economics) relating to North Africa and other regions in the Mediterranean basin. The courses constituting agricultural instruction proper then follow in rational order up to the end of the course.

Thr first year studies are suspended about June 15 to enable the pupils to go to the annexe at Berteaux for a period of practical instruction.

To prevent the number of pupils from making teaching difficult, the following arrangement has been adopted:— At the end of the first year the pupils are divided into two groups:— In the first those who have already carried out reaping and threshing or who can do so with their relatives or on private farms; in the second the remaining students.

The first group begins the vacation on or about June 10. — The pupils in the second group go on that date to the annexe, where they take part for about six weeks in the work of reaping and threshing, in mechanical tillage and all other work done at this season.

The pupils of this group then have their holiday until early in September Those who so desire are permitted to prolong their stay at the annexe during the month of August on condition of making themselves useful on the estate.

During September, the pupils of both groups, either singly or in small sections, go under the direction and control of the professor concerned, and take part in the gathering of the grapes, and wine-making, either in co-operative cellars or with private persons.

When this new period is ended the second group goes on holiday while the first group goes to Berteaux to take part in the seasonal work (ploughing, sowing, etc.), mechanical tillage and other work already done by the second group.

By helping in the farm work at the annexe when there is much to do, the pupils live the life of colonists and receive the most practical of lessons. They learn, by use, the handling of implements and machinery, the driving of teams and the care of various animals; they are initiated into the keeping of farm accounts, the cost of materials and of work, the management of a farm; in short they learn for themselves the practical difficulties which the farmer has to deal with. About November 15, the two groups of the year meet at Maison-Carrée to take their second year's course which ends on July 13.

When going from Maison-Carrée to Berteaux and *vice versa* as well as during their stay at the annexe, the pupils visit as many interesting farms and installations as possible in the eastern part of Algeria and the corresponding southern territory (oasis of Biskra-Touggourt).

For the Easter holidays are substituted one or more excursions in the second year, as much as possible in the west of the Colony so that the pupils visit the various agricultural regions of the country while under training. These tours are both useful and pleasant and form an excellent preparation for colonial life; as may be imagined, they are much appreciated by the pupils.

Besides these long excursions, numerous and varied shorter excursions are made under the supervision of professors appointed for the purpose.

Owing to this rational succession of periods of study and application and of essentially practical work which characterises the organisation of the course at the Agricultural Institute of Maison-Carrée, the Institute, without overworking the pupils, gives them a very complete technical and professional training.

They are thus initiated into the theory and practice of the colonist's work, thus answering the objections of those who consider that an Agricultural College should leave the students to learn practical agriculture after leaving the College so as to avoid subjecting them, during the theoretical course, to physical fatigue and to a prolongation of the time spent at the College, which would be a consequence of the introduction of practical work into the syllabus.

A judicious distribution of the examinations makes it possible to avoid the sudden stops, extremely deplorable for the training of the students, which are caused, in most teaching institutions by grouping these tests at the end of the academic year. The adjournment of the commencement of the second year also enables the students to profit by their stay at Berteaux, in the co-operative cellars and even the holidays for the revision of related subjects.

The students are required to carry out work themselves and this furnishes the best criterion of their power of judgement and sound appreciation of agricultural questions. The students who pass all the tests required by the regulations receive: —

1) The diploma of the Agricultural Institute of Algeria in the case of those who in the final classing obtain an average of not less then 13.

2) The diploma of Engineer of the Agricultural Institute of Algeria in the case of those who obtain an average of not less than 15, and with no mark below 13 in the final examinations.

The first six students of each year are admissible, as boarders or day students at their option, for a third year course either in the laboratories of the Agricultural Institute where they complete their studies and may even help as assistants, or at the Colonial School of Arts and Crafts (now established at Dellys while awaiting transfer to Maison-Carrée), where they learn the application of the industrial arts to agriculture.

The students of the Agricultural Institute of Maison-Carrée can also put in a period either at the Hamma Experimental Garden with a view to perfecting themselves in horticulture and arboriculture, or at one of the Experimental Stations which are in course of organisation in the Algerian departments and even in the Southern Territories. During these periods they are lodged and may be paid a remuneration proportional to their services.

Lastly, their admission to the National Colonial Agricultural College (at Nogent-on-Marne, Seine) enables them to acquire supplementary knowledge of a kind which facilitates their establishment and success in distant possessions.

OPENINGS OFFERED TO THE STUDENTS. — The particularly rapid progress of French North-Africa, the unlimited scope and the profitable investments which — from Gabes to Agadir — it offers to work and capital and the special attraction which it has to all those who have lived under its sky and experienced active life in its fields, still imperfectly developed, have, up to the present time, led most of the students of the Agricultural Institute of Maison-Carrée to settle there.

Thanks to the good professional training of these young men, Algeria, and the Protectorate of Morocco especially, offer them almost unlimited openings such as the management or establishment of farms, situations as agents and stewards, various situations in agricultural industries (wine-making, distillation, manufacture of oils and essences, preservation of food stuffs, dairying, etc.), as well as in numerous branches of commerce and industry in which knowledge acquired at the Institute (agricultural machinery trade, chemical products and fertilisers, hides, and wool, etc) can be utilised.

Syria also appears to offer an interesting field of work to energetic and enterprising former students of the Institute

According to the orders of the Governor General dated March 26, 1915, and in compliance with the provisions of the Decree of September 12, 1904, which makes adequate agricultural knowledge one of the conditions for obtaining free grants of land for settlement in Algeria, the diplomas of the Agricultural Institute of Maison-Carrée constitute a supplementary title which the Government will take into serious consideration when inquiring into the records of the applicants for a grant of land. Just as Morocco at present finds the fundamental elements of its colonisation, in the Algeria-Tunisian Colony, so, there is reason to think, with the protagonists of the "African Railway", that from the day — doubtless very near — when Northern Africa will be united by rail to other French possessions in Africa, its colonists will be attracted towards the Niger and the Congo, just as the Americans journeyed from the Atlantic coast right out to the Far West, and there is even in this direction also an interesting prospect of openings for the technicians trained at Maison-Carrée.

Although the Agricultural Institute of Maison-Carrée interests itself in directing its pupils towards undertakings due to private initiative, a certain number of them can also obtain situations in the Public Services of North-Africa, particularly those requiring agricultural knowledge (agricultural laboratories and services, farm engineering, tobacco growing service, topographical service, etc.).

A number of young students will thus find a means of acquiring a more complete knowledge of the country, while making a livelihood or while waiting until they are able to set up as farmers.

Lastly, in terms of the Decree of October 22, 1916, posts in the General Agricultural Service of Algeria are reserved for Candidates with diplomas of one of the French Agricultural Colleges or of theAgricultural Institute of Algeria.

RECRUITMENT AND ADMISSION OF STUDENTS. — The Agricultural Institute of Maison-Carrée recruits its students from those who have finished their course in the higher primary schools, establishments of secondary teaching (at least up to the first class) or the technical agricultural schools of France or of foreign countries. It cannot be too strongly recommended to parents who wish eventually to send their children to the Institute, to give them a good general education, which alone can supply solid and lasting foundations for professional instruction. Candidates must be fully 17 years of age at their entrance.

Admission can be allowed either after a competitive examination held yearly about July 10, or exceptionally without competition.

The competitive examination is entirely written, and can be taken in France, Algeria, Tunis, Morocco, in other Protectorates or Colonies (principal centres) as well as in foreign countries (French Consulates).

On the other hand, candidates who qualify for admission to National Schools of Agriculture, by the holding of the Baccalauréat or of a Higher Certificate of primary teaching or else who possess equivalent qualifications, may be admitted without competition up to the commencement of the academic year. Foreign candidates have to fulfil all the same conditions as to entrance as French subjects. They can also obtain admission to the Agricultural Institute of Algeria on production of degrees or diplomas of their native country equivalent to those required from French candidates.

In short, the Agricultural Institute of Algeria, by its situation, its equipment — for which considerable sacrifices have been agreed to in the Algerian budget — the qualifications of its teaching staff, the wide and remarkable means of study which it places at the disposal of its students, the high standard of its teaching and the perfect adaptation of this to the special conditions of agriculture in the North of Africa and regions with a similar climate, the variety of openings offered to its students, and by the low rate at which the cost of living is kept, deserves to be brought to notice.

An institution of agricultural teaching which can compare favourably with the most famous of similar estalishments in France or foreign countries, an agency for experiment and diffusion of knowledge, the importance of which is bound to increase as its work extends, the Agricultural Institute of Algeria — which is, moreover, an excellent instrument for colonisation — constitutes one of the most interesting of agricultural centres, and is destined to a most promising future.

SECOND PART
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

592 - **Agricultural Development of the State of Matto Grosso, Brazil.** — BECCARIA D'INCISA, J., in the *Annales da Sociedade Rural Brasileira*, No VIII, pp. 459-463, 2 figs, 1 map Rio de Janeiro, Feb. 1921

The State of Matto Grosso, which promises a rapid economic development, attracts ever increasingly the attention of scientists and practical persons, as well as the capital and the energy of several contractors helped by the intelligent, co-ordinating work of the President of the State, Don Francisco DE AQUINO CORREÃ.

The industrial future of the State is assured by its richness in minerals such as antimony, platinum, tin, iron, argentiferous lead, copper, mercury, lead, etc., and by the great waterfalls which can be used for powerful hydro-electric installations. In the south, on the Rio Paranà, a short distance from Tres Lagoãs, are the falls of Orobú Pungà, which could develop 650 000 HP, and on the border of Paranà, the " Sete Quedas ", able to furnish an estimated total of 8 million HP.

Agriculturally, the natural, ever-verdant pastures, the plains of the Paraguay and of its tributaries (whose pastures are enriched and fertilised every year by periodic inundation) and the plains of Vaccaria rival in fertility the Nile alluvions.

The State of Matto Grossl (1 556 275 sq. km.) is covered with immense forests, rich in copaiba, ipecacuana, coconut palms, cacao trees, etc., which only need labour to be suitably worked. Sugar cane gives spendid results throughout the country, and canes whose productivity is prolonged for 20 years are not infrequently met with. Sugar factories in fairly large numbers are already in existence along the Paraguay and the Cuyabá.

Tobacco, palms, bananas, maize (which grows to a height of 5 m.), cotton (which assumes an arborescent habit), lemon trees, orange trees, vines, vegetables, rice (which yields 2 crops a year) constitute a variety of sources of wealth which are, as yet, scarcely utilised. Coffee appears to give excellent results, better perhaps, in some zones than those of San Paulo, An enormous number of indigenous fruits make up the flora of Matto Grosso. Yerba Maté (the leaves of *Ilex paraguayensis*) is the monopoly of the Campanhia Matte Laranjerà which pays the State very high royalties.

The cattle of Matto Grosso, universally prized, belong to the Caracu and Zebu breeds. The improvement of these breeds has now been commenced by crossing them with breeds imported from Europe and the United States.

The following data of exports during 1904, gives an idea of the importance of cattle breeding:—

Coxim	800	head
S. Anna de Parahybo	71 291	»
S. Rita de Araguaya	1 895	»
Tres Lagoñs	376	»
Noroeste do Brasil	938	»
São Carlos	3 072	»
Porto Murtinho	3 777	»
Bella Vista	5 148	»
Ponta Porà	4 546	»
Nhú Verá	819	»
Porto Jguatemy	1 345	»
Porto XI de Novembre	34 090	»
	128 097	head

The chief breeding establishments are in the south and in the north; the following are some of the best known:— São João de S. Anastasio, Col. Barros, Miranda, Estancia Cia Ltda, Bandeira, Descalvado, Franceza, Porto Alegre, Joffre, Triumpho, and several others.

For sheep breeding, the establishment of Tres Barras, near Porto Murtinho on the river Paraguay, is well known.

593 - **Food Ration and Vitamines.** — DESGREZ, A. and BIERRY, H. in the *Comptes rendus des séances de l'Académie des Sciences*, vol. 172, No. 17, pp. 1068-1071. Paris, April 25, 1921.

On a previous occasion the authors investigated the specific food requirements of the organism (1) and basing their experiments on the indispensable factor of nitrogen balance they first inquired within what limits isodynamic nutritive principles could replace one another without injury to the organism, that is to say be physiologically equivalent.

Experiments on rats placed on synthetic diets deficient in vitamines showed that nitrogen equilibrium could be ensured, for a certain time, by fixed proportions of proteins, sugars and fats, in a given ration of sufficient energy value; that the minimum of each of the three elements depends on the chemical structure and the proportion of the two others; and, lastly, that the minimum of nitrogen is reached when a high percentage of a carbo hydrate is present in the ration.

What happens to an animal receiving a well balanced ration when one of the constituent elements of that ration is suppressed, while the percentage of the two others, or of one of them only, is raised in parallel, in proportion to the calorific power? This was the question which the authors investigated in the further experiments dealt with in this paper.

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(1) See *Comptes rendus de l'Académie des Sciences*, vol. 171, 1920, pp. 1209 and 1393: *R.* July-August, 1920, No. 712. (*Ed.*)

Comparing these experiments with those of MAC COLLUM and DAVIS, DRUMMOND, and HINDHEDE (2), it appears that, on the one hand with food deprived of fat, containing only albumins and carbo-hydrates, but rich in vitamines, the growth of the young animal and equilibrium of the adult can be ensured, and that, on the other hand, in avitaminosis (lack of vitamines), the nitrogen-balance can only be maintained if the constituents of the ration are all present in certain proportions in the diet.

It must, then, be admitted that the quantities of the complementary factors *A* (fat soluble), *B* (water soluble) and *C* (antiscorbutic), required by the organism, vary not only with the kinds of food, but also with the proportions of these kinds present in the ration; it must equally be admitted that each kind of food exercises a functional rôle, in the chemical sense of the word, in the intermediate metabolism of the two others.

Already the fact that no substitution can exist between carbohydrates and fats, compared with the same albumen, and that the catabolism of certain aminic acids and fatty acids (cetogenic) is regulated by the sugars, indicated the importance of the chemical function and structure of the food. As the splitting-up of the proteins, sugars and fats comprise simultaneous phenomena, giving rise to products reacting on one another, it must be admitted that if, by the contribution of nourishment, these combinations are ensured, the reserves enter little or not at all into action. Different processes probably result, brought into action by the organism; some of which require the more or less essential assistance of vitamines.

594 – **Poisoning Caused by Vetch Seeds.** — See No 641 of this *Review*

595 – **Bovine Foot and Mouth Disease is not Transmissible to Man, and Human Aphthic Stomatitis is not Transmissible to Cattle.** — See No 644 of this *Review*

596 – **Work of the Agricultural Department, Dominica, West Indies.** — KEYS A., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information,* No 2, pp, 67-85 London, 1921

The Agricultural Department of Dominica started as a Botanic Station 28 years ago and since then has made rapid progress in many ways.

The author gives a descriptive account of the work done by the Botanic Gardens from the economic aspect, and of various experiments and methods adopted as regards agricultural instruction in connection with the Department

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(2) See *R*, Apr 1916, No 415, March, 1917, No 260, June, 1917, No 556, Jan. 1918, N° 2, Feb 1918, N° 125, Aug 1918, N° 34, Jan 1919, No 6, Oct-Dec 1919, Nos 1068 to 1072, Jan, 1920, Nos 3, 4 and 5, Feb 1920, No 157; Apr 1920, Nos 380 to 382 (*Ed*)

A survey of the collection of flowering trees and shrubs, palms and other ornamental plants such as *Pandanus* spp. Bamboos, Conifers, Succulents, etc. now in the Botanic Gardens, is made, followed by details of the economic section in the said Gardens. The latter collection comprises most of the principal economic plants in the tropics. Several kinds of coffee are grown, the two principal vanillas, cola nuts, most of the recognised rubber trees, landolphias, nutmegs, cinnamon, camphor, mangoes, mangosteens, durians etc. all either of medicinal or other economic importance. Manurial experiments were started in 1900 and 1907 respectively both on the flat and on the slope, to ascertain the manurial requirements of cocoa growing elsewhere in similar situations (1). The cocoa and lime yields, together with miscellaneous fruits and spices from other economic plants in the collection are a source of considerable financial support to the Department.

NURSERIES: — In connection with nursery work in the Tropics, the humus question demands careful attention, and the method adopted in the Botanic Gardens, where lime seedlings are grown on the same piece of land year after year is as follows: the beds and paths running between them are made the same width, the paths being filled with grass which has been trampled under foot, and thereby converted into a more or less decaying mass, are dug up and converted into beds, the beds of the previous year being made into paths. In this way the ground serving as paths for 1 year receives a good dressing of organic matter, and is rested for a period of 12 months.

Two large nurseries meet the requirements of the planters in Dominica. Budded citrus, sugar cane, rubber, coffee and miscellaneous stock are supplied to the new planter at any time required, to plant up newly cleared forest land. In addition to nursery plants, there is also a considerable distribution annually of seeds of rubber, coffee, green dressings, fodder grasses, shade trees, papaws and vegetables.

During recent years, efforts have been made to encourage planters to cultivate on the rotation system and change their former method of planting one crop to the exclusion of all others. Previously coffee was practically the only crop cultivated and the present staple crop, namely, limes, had not been thought of in Dominica; in fact, sugar seems to have predominated after the failure of the coffee crop, and limes only came in gradually with the decline of the sugar industry, when beet began to take an important place in the world's sugar supply, and the price of this commodity fell below the cost of production.

Of late years cocoa planting has been encouraged by the Department and every attempt has been made to extend its cultivation to districts which, prior to experimental work commenced on this crop, were considered unsuitable. The superior Criollo type refuses to thrive in any part of the island, but after much valuable work in budding and grafting of cocoa, a good medium grade can now be grown by grafting the Forastero type on the hardy Calabacillo stock. The latter type in itself yields a very inferior grade of produce, but its immunity from disease, as well as its indifference to soil and climatic conditions, makes it invaluable as a grafting stock.

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(1) Results to be published in the Annual Agricultural Report, Dominica 1921.

Experiments were started in onion growing a few years ago, with a view to encouraging cultivation of this crop to supply local needs. Seeds were imported from Teneriffe and sown in the nursery, and seedlings distributed free of charge. Since then the demand for seedlings has rapidly increased. Onions have now become a remunerative crop, and, local needs having now been satisfied, it has been added to the list of exports.

In 1913, the Government started manurial experiments at the Lime Experiment Station, (moist compact soil) but owing to the serious damage effected by means of a hurricane in 1916, the plots were reorganised, and in 1917 the present system of experiments was inaugurated. Reliable and useful results cannot be expected for some time to come. It would appear, however, that a complete fertiliser (dried blood + basic slag + sulphate of potash) can be expected to give satisfactory results: It is expected also that mulch such as cut grass and bush will, when applied every 2nd year alternating with a complete fertiliser, become an important consideration in every practical scheme of plantation manuring.

Observations have also been made on budded limes, disease resistant stock and the effect of green dressing crops *i. e.*, horse beans (*Canavalia ensiformis*), *Tephrosia candida*, or weeds and grass clippings. The yield obtained from the plot of trees grown without green manure compared unfavourably with the others. There was also a great increase in yield from the trees grown with *Tephrosia* compared with those grown with horse beans, in the second year of bearing (139 barrels * per acre: 72 bar. per acre). This may be due to the height of *Tephrosia* and the consequent better protection afforded. When it is considered that the ordinary seedling lime tree does not usually commence to bear fruit until the 4th or 5th year, and even then only sparsely, the results here obtained demonstrate the advantages in planting budded trees. Observations made on lime cultivations by the Department, extending over a good number of years, have shown that the lime tree has a critical period, beginning at the time of planting in the field and continuing up to the 3rd year. An annual application of 2lb. organic nitrogen per tree in addition to green dressing crops, should be given during this period.

The present yield of limes from the 25 acres of the Experimental Station is approximately 2000 barrels per annum (1). This is estimated to rise to between 3 000 and 4 000 barrels per annum as the newly planted land comes into bearing and later to 6 000 and 7 000 barrels with all trees in full bearing.

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* 1 barrel = 4½ cub. ft. capacity

(1) During a recent visit to Dominica S. M. DAVIS. (Chief Chemist to Messrs ROWNTREE Co , Cocoa Manufacturers, York) made investigations concerning the loss of citric acid which may occur in limes and in lime juice under certain conditions. Sets of 50 limes of various degrees of ripeness were hand pressed, the juice from each set measured, and its acidity determined. The yield in lb. of citric acid per barrel was as follows :— ripe yellow limes

A lime factory is now in process of construction where, if experimental work is conducted in conjunction with field operations, results might bring to light an improved means of working the present lime industry.

Experimental tapping tests are being carried on with *Hevea brasiliensis* on the Morne Bruce Lands.

AGRICULTURAL INSTRUCTION. — The only course of instruction for boys intending to take up. agricultural work professionally, is established in the Botanic Gardens. This does not however deal with livestock management, but is organised with a view to preparing the pupils to take up positions either as overseers or managers on planters' estates.

Courses of reading and examinations in practical agriculture were established under the direction of the Imperial Department of Agriculture for the purpose of enabling overseers on estates and others engaged in agricultural work to acquire knowledge that would be useful in connection with their practical work. The war however, upset these arrangements and they have not yet been re-established owing to the general unsettlement.

A system of Agricultural Cadet Training is, however, in practice.

A laboratory has been fitted up in the Botanic Gardens to enable the Department to deal with the analysing of lime juice, milk and other foodstuffs, soils and manures, etc. This does not interfere in any way with the central laboratory in Antigua supported by the Imperial Government for research work in the Leeward Islands in regard to the more important chemical investigations. All important matters are still submitted to the Government Chemist in that island; and only such work as mentioned above has been undertaken locally.

CROPS AND CULTIVATION

597 - **A New Classification of the Soil Moisture.** — BOUYOUCOS, G. (Michigan Agricultural Experiment Station), in *Soil Science*, Vol XI, No 1, pp 33-47, Bibliography of 9 works. Baltimore, January 1921

The water in the soil is now generally divided into 3 forms; gravitational, capillary and hygroscopic; but this classification is empirical and fails to reveal the true facts. The author's method which consists in determining the freezing-point by means of a dilatometer (1) allows of a clas-

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5.3, yellow green 4 9, over-ripe 4.6, green 4 4, rotten 1 7 With lime juice, 200 lb stored 19 days was reduced to 184 lb. by evaporation, and the acidity from 12 1 oz. to 11 3 oz A loss was recorded of 1.7 oz. of citric acid per gallon.

During the first few weeks of storage, the loss of citric acid is on an average 5 % per week of the original content. Storage for long periods must therefore result in a big loss to the planter (*Agricultural News*, vol. XX, No. 492, p. 75 London, March 5, 1921).

(1) See *R*. 1917, No. 896; 1919, No. 567; Cf. also *R*. 1920, Nos. 388 and 945. (*Ed*)

sification of soil moisture founded upon a scientific basis and upon physiological principles. He divides it under the following heads:

Gravitational water : superavailable
Free water : very available
Unfree water { capillary-adsorbed
    combined { Water of solid solution
        Water of hydration

The gravitational water is that which, being in excess of the amount the soil is able to retain, can be drawn away by the force of gravity; the free water is that which freezes for the first time at the supercooling of — 1.5°C.; the capillary-adsorbed water is that which freezes finally at 4°C. and also in the temperature of —78° C., minus the free water. The combined water is that which does not freeze at all.

The procedure of the new method consists of introducing a definite amount of soil and water, or a soil of known moisture content, into the dilatometer, filling the empty space with ligroin, and then causing the soil moisture to freeze. It is first supercooled to —1.5°C in order to freeze the free water, then the contents of the dilatometer are thawed and frozen at the temperature of —15°C. for half an hour. Then they are thawed again and supercooled to —4°C where the capillary-adsorbed water freezes. When the contents come in equilibrium with the temperature 0 —4°C., they may be cooled to — 78°C., and brought back again to the temperature of —4°C. When the coefficient of expansion of water upon freezing and also the total water content of a soil are known, then it is easy to determine the water freezing at —1.5°C., that freezing at —4°C., and the water that does not freeze at all, even at — 78°C. On the basis of this classification, it was found that in some soils (in addition to the possible water of gravitation), only 2 forms of water exist, while in others there are all 3 forms, but in different proportions.

This new classification of the soil moisture gives a clearer and deeper insight into the actual condition of this moisture, its intimate and complex relationships with the soil, and its bearing upon many phenomena in the latter, such as the movement of moisture, evaporation, the wilting coefficient of soils, the availability and unavailability of moisture etc.

A direct comparison made between the wilting coefficient (1) of some of the soils employed by BRIGGS and SHANTZ and the dilatometer method results show, that the percentage of moisture which fails to freeze at the supercooling of —1.5° C. coincides very closely with the amount of moisture at which plants begin to wilt. In view of the close agreement that appears to exist between the wilting coefficient and the unfree water as determined by the dilatometer method, it would seem advisable to adopt this way of determining the factor which is more accurate, constant and convenient than the determination of the wilting coefficient by means of the plant. ALWAY's hygroscopic coefficient (1) seems to represent about the same degree of moisture as the combined water of the proposed classification (2).

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(1) See *B.* 1912, No 903. (*Ed*)

598 - **Soil Ingredients Withdrawn by Various Fruits.** — COLBY G. E. (Chemist and Assistant Chief. Division of Chemistry. State of California Department of Agriculture) in *The Monthly Bulletin of the Department of Agriculture, State of California, Chemistry Number*, Vol. X, No. 1, p. 23., Sacramento, California, Jan. 1921.

For a number of years the author was engaged in the study of chemistry of fruits and among other data, a table is here reproduced showing the amounts of several important soil ingredients contained in 1000 lb. of various fruits in fresh condition.

The replacement of the vital soil ingredients, *viz.* nitrogen, phosphoric acid, and potash, withdrawn from soils by fruits, as shown in the appended Table, was begun years ago by employing for certain fruits, commercial fertilisers containing plenty of nitrogen and phosphoric acid, and to a comparatively limited extent, potash. Californian soils are scantily supplied with the two first mentioned ingredients, but contain ample potash.

The California Experiment Station recently received for examination a specimen of olive oil residue which consisted of a mixture of dried pulp and coarsely crushed pits of the olive containing 2.75 % of oil.

Fresh fruit (Lot of 100 pounds each)	Total ash	Potash (K_2O)	Lime (CaO)	Pospniric Acid (P_2O_5)	Nitrogen (N)
	Lb.	Lb.	Lb.	Lb.	Lb.
Almonds	17.29	9.95	1.04	2.04	7.01
Apricots	5.08	3.01	0.16	0.66	1.94
Apples	2.64	1.40	0.11	0.33	1.05
Bananas	10.78	6.80	0.10	0.17	0.97
Cherries	4.82	2.77	0.20	0.72	2.29
Chestnuts	9.52	3.67	1.20	1.58	6.40
Figs	7.81	4.69	0.85	0.86	2.38
Grapes	5.00	2.55	0.25	0.11	1.26
Lemons	5.26	2 54	1.55	0.58	1.51
Olives	13.50	9.11	2.43	1.25	5.60
Oranges	4.32	2.11	0.97	0.53	1.83
Peaches	5.30	3.94	0.14	0,85	1.20
Pears	2.50	1.34	0.19	0,34	0.90
Prunes, French	4.86	3.10	0.22	0.68	1.82
Plums	5.35	3.41	0.25	0.75	1.81
Walnuts	12.98	8.18	1.55	1.47	5.41

An analysis of this residue showed that it contained :—

Water 10 % ; organic matter 87.73 % ; ash (or mineral matter) 2.17 %.

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(1) See *R.* 1917, No. 1114; 1918, Nos. 128 and 957.

(2) See *R.* 1917, No. 227. (*Ed.*)

Further analysis showed that the plant food content per 1000 lb. refuse was as follows :— nitrogen 8.04 lb.; phosphoric acid 4.30 lb; potash 4.90 lb.

The value of this kind of refuse as a fertiliser may be judged by the conclusion that the benefit of adding so much organic matter as is contained in this material is somewhat lessened by the quantity of oil and crushed but hard and non-decomposed olive pits. Also, as the plant food ingredients are known to exist chiefly in the pits, this material must be classed as slow acting, and not of a great value as fertilising agent.

599 - **Distribution of Titanium in Soils and Plants.** — GEILMANN (Arbeiten aus dem landwirtschaftlichen Versuchsfelde der Universität Göttingen), in *the Journal fur Landwirtschaft*, Vol. LXVIII, pp 107-124 Berlin, 1920

Recent lithological research has shown titanium to be one of the elements most widely disseminated in the earth's crust, of which it is said to form as much as 0.33 % (F. W. CLARKE). Given the high titanium content of clay, it might be supposed that larger or smaller quantities of this metal would be found in ordinary agricultural soils but, as a matter of fact, in scientific literature dealing with this subject, it is very seldom that any data are given respecting titanium, which is usually expressed as alumina. The author suggested the use of HILLEBRAND'S system of determination, which consists of a special method of disintegration followed by a colorimetric estimation, and used it himself in the examination of 30 soils (including peaty and calcareous types, sands and clays)

He found that the amount of titanium dioxide present varied from mere traces in the case of sandy loan, to over 1 % in that of clay. Further, there was a certain regularity in the distribution of titanium in different soils, clays containing most, clay loans less, and pure sands and clays. very little indeed. Nevertheless, some titanium was found in all the soils, and usually the percentage of the dioxide was such that its omission in analysis would have constituted a distinct error. Considerable quantities of titanium pass into an acid solution, and if they are not estimated, the determination of the alumina is not correct, for they sometimes equal, or exceed, the ordinary content of fertilising substances (in % of dry matter) (see Table II).

TABLE I. — *Percentage of titanium dioxide in various soils.*

Soils	Total titanium dioxide Per cent.	Titanium dioxide soluble in boiling 25 % H Cl Per cent.
Cultivated alluvium . .	0.325—0.355	0.081—0.100
Clay	0.952—1.008	0.083—0.086
Clay loam	0.667—0.619	0.090—0.097

The constant presence of titanium in the soil having been proved, it was important to determine how much was to be found in the ash of plants. For this purpose cultivated plants were selected, which with the exception of cacao, had been grown on the same alluvial soil containing 0.336 % of titanium dioxide.

Table II gives the results of these determinations.

TABLE II. — *Percentage of titanium dioxide in different plants.*

Plants	Ash per cent.	Titanium dioxide in the ash per cent.	Titanium dioxide in air-dried material per cent.
Horsetail	25.34	0.071	0.0180
Nettle	15.70	0.056	0.0088
Potatoes, leaves	6.89	0.269	0.0186
Potatoes, tubers	0.75	—	—
Lupins, straw	7.66	0.059	0.0045
Maize	11.05	0.032	0.0035
Mangolds (roots)	12.30	0.009	0.0011
Do. (leaves)	19.38	0.022	0.0042
Green oats	7.70	0.005	0.0004
Autumn wheat	9.52	0.004	0.0004
Beans	6.35	0.061	0.0039
Galega	7.51	0.059	0.0044
Pears	2.23	0.009	0.0002
Pear trees, leaves	6.67	0.057	9.0038
Pear trees, wood	4.35	0.007	0.0003
Apples	2.57	0.016	0.0004
Red cabbage	9.28	0.003	0.0005
Cacao seeds	4.34	—	—
Grass (5 samples)	8.78-9.71	0.021-0.027	0.0019-0.0027

All the plants, except the cacao seeds, contained titanium, the maximum amount being found in the potato leaves ; in every other case, the amount of titanium dioxide was below 0.1 % and often less than 0.05 % of the ash, and though it varies perceptibly, a certain rule seems to hold good, leguminosae, wheat and oats having the same titanium content, whereas that of meadow-grass is higher. The metal seems to accumulate by preference in the assimilating organs, which proves the truth of TRAETTA MOSCA'S statement (1), that titanic acid is of great physiological importance to plants (tobacco), since it acts as an oxidising catalyst.

The estimations made in the case of meadow grasses are also useful, as they show the possible effect of soil moisture on the absorption of titanium dioxide, but no differences worthy of remark were observed.

Chimica Italiana, XLIII, 437-440, 1914. (*Ed.*)

[599]

600 - **Comparative Investigation of the Microflora and the Nitrogen Content of Soils partially Sterilised with Calcium Sulphide.** — TRUFFAUT, G. and BEZSONOFF, N., in the *Comptes rendus de l'Académie des Sciences*, Vol. 171, No. 4, pp. 268-271. Paris, July 26, 1920.

According to the author's observations (*Comptes-rendus de l'Académie des Sciences*, Vol. 170, 1920, p. 168), the bacterial flora of soils treated with mixtures having a basis of calcium sulphide contains an abundance of a nitrogen-fixer, *Clostridium pasteurianum*, an the principal ammonifying bacteria of the soil (*B. mycoides*, *B. megatherium*, etc.).

As such a typical selection of micro-orgaisms was present, investigation of its influence on the soil nitrogen seemed desirable. The authors, therefore, estimated nitrogen contents of partially sterilised soils and in similar but sterilised soils, establishing at the same time their bacteriological control. The results obtained seem to prove that:—

1) By using a strong dose of aromatic carbides and sulphides in cultures in porous pots where oxidation is constant, this acrobic medium favours the loss of ammoniacal nitrogen by diffusion, and is unfavourable to the sustained growth of anacrobic bacteria such as *Bacillus butyricus*.

2) When, under the same conditions, the same soils, still contained in porous pots, bear plants, it is found that the loss of nitrogen is smaller.

3) Under conditions of cultivation in open fields and using a maximum quantity of 150 kg. of calcium sulphide per hectare, it is noted that, in spite of the large amount of nitrogen removed, the soil is never impoverished of this element.

601 - **The Part Played by Rain in Supplying the Water Table.** — DIÉNERT (Chef du Service de la surveillance des eaux d'alimentation de Paris), in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. III, No. 5, pp. 97-104. Paris, February 2, 1921.

The subject dealt with by the author is part of the problem which arises when any scheme of irrigation or water supply is under consideration.

The only basis upon which an engineer is able to estimate the amount of water that can be supplied by a given area of land is the rainfall registered by the various rain-gauges.

Of late years, however, certain new theories have been brought forward to the effect that rain is not the only source from which the water tables obtain their supplies.

It is, on the contrary, affirmed, that the condensation water produced by mists and dew, and even the water condensed on trees (1) all contribute to maintaining the level of this subterranean water.

Without entering into a discussion as to the merits of the different hypotheses, the author has tried to ascertain whether the readings of rain-gauges can, despite these new theories, still be used. In his studies, he utilised the systematic and accurate data collected regularly for many years by the City of Paris for the purpose of determining the water-flow of the Vanne in Burgundy, and of the Avre in Normandy. From the results of the calculations which he gives, the author draws the following conclusions :—

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(1) See *R.*, March 1919, No. 280; *R.*, March 1920, No. 292. (*Ed.*)

There is a practically constant ratio between the water carried by a stream, from the moment where its flow begins to increase, until the time when it resumes its initial volume on the one hand, and the amount of water that has fallen on the perimeter during the same time on the other, provided that the period is not less than 2 years.

The data afforded by rain-gauges therefore are sufficient to enable hydraulic engineers to calculate the amount of water that can be obtained from a water-table for purposes of irrigation or water-supply, for if water from other sources assists in feeding the water-table, this contribution is closely connected with the rainfall of the region.

602 - **Watering by Imbibition in Market Garden Cultivation.** — STAPPAERT, E., in the *Revue horticole belge*, Year 2, No. 5, pp. 64-66, figs 1. Huy, May 1, 1921.

The system proposed by the author is intended especially for greenhouses. He tried it in 1917 and the results have been so conclusive that he has generalised its use in all the greenhouses belonging to the State School of Horticulture at Vilvorde used for the cultivation of vegetables in plots. At a depth of 35 to 40 cm., drainpipes 7 cm. in diameter are placed in the ground, without joints, but end to end as if for drainage. These pipes are laid level, the lines of pipes being about 1.50 metres apart. At the two ends of the lines, the last pipe is fitted with another pipe placed vertically so that water may easily be poured down it.

If the soil of the greenhouse is about level and if its length does not exceed 40 m., the lines of pipes are arranged lengthwise with the greenhouse. In case the ground is inclined or if the length exceeds 40 m., the pipes are placed so as to form lines parallel with the gable ends of the greenhouse. This arrangement is necessary so that the lines of pipes may be level and always about 35 cm. below the surface of the soil.

When watering is to be done, water is allowed to flow through the pipes by placing the end of a rubber tube into the pipe placed vertically, the other end of the rubber tube being fitted to the nearest water tap. If water is not laid on, it is poured into the vertical pipe from watering cans. The water is allowed to flow until it is seen, by looking down the vertical pipe placed at the other end of the line, to have reached the end of the line. The end of the rubber tube is then moved to the vertical pipe of the next line.

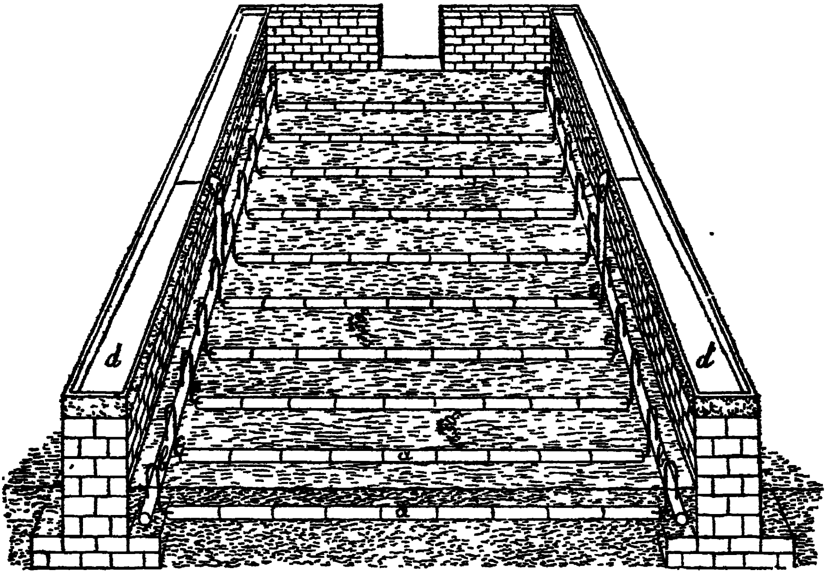
When the first watering is being done, especially if the lines of pipes are fairly long, it sometimes takes more than an hour for the water to reach the end of a line. This is because the earth absorbs so much at each joint of the pipes where the water escapes.

With the second watering, the time required diminishes and after three or four operations it scarcely takes a quarter of an hour for each line.

The water which flows in the pipes escapes into the soil at each junction of the pipes, saturates the surrounding soil and, by capillarity, mounts to the surface of the soil.

In successive waterings the water is poured alternately into the vertical pipe at each end of a line.

With this system it is also possible to distribute, to each line of pipes the rain water which falls on the roof of the greenhouse and to distribute it over the whole area of the covered soil. With this object a system of pipes 8 to 9 cm. in diameter, such as are used for hot water heating is connected with the down-pipe from the greenhouse roof, and divided into two sections so that each section forms a conduit joining up one end of each of the lines of pipes in front of which it is placed.



STAPPAERT system of watering by imbibition.

So that each line of pipes shall automatically receive the same amount of water, a small gas tube of about 1.5 cm. gauge is grafted on the pipe which holds the rain water and rising perpendicularly from it is bent at a certain height and turned downwards to enter the line of drain pipes. If all the bends of the small tubes are exactly on a level these tubes constitute so many communicating vessels and each will divert the same quantity of water into each line of drain pipes.

The drain pipes used are 30 cm. long and now cost 250 fr. per thousand.

603 - Plant Analysis in Relation to Manuring. — MÜNTER, F. (Stellv. Vorsteher der Agrik.-Chem. Versuchsstation Halle), in the *Journal fur Landwirtschaft*, Vol. LXVIII, pp 207-224 Berlin, 1920.

The author had remarked that, in studying the relations between the results of elementary analysis and the need of fertilisers, it was not suitable to make use of spring barley; much clearer indications, however, are obtained with sugar beet, which is much more exacting in the matter of manuring. The following information resulted from observations both on barley and beet on loess silt soils:—

a) Nitrogenous and phosphatic manures reduce the silica content of barley straw; on the other hand, the lime and magnesia content is only influenced to a negligible extent by nitrogenous, potassic or phosphatic manures; the atmospheric conditions of the year have so intense an influence on the growth of barley that its nitrogen, potash and phosphoric acid content does not allow of any certain conclusion being drawn so far as the needs of fertilisers for a soil are concerned. However, the nitrogen content of barley is slightly reduced by potash and very much reduced by phosphoric acid; all this confirms the fact that barley is not a plant which should be used in these experiments; the ratio of nitrogen to potash or phosphoric acid gives no certain indication of the fertility of a soil.

b) The yield in root of beet in good years, but in determined conditions that are unfavourable to the assimilation of phosphoric acid, is influenced by nitrogen, and slightly by potash. In any case the epigeal production depends considerably on the nitrogenous manuring. The lime and magnesia content of the roots is only influenced in an accessory manner by the manuring; in straw, on the other hand, the lime and magnesia content is increased by potassic fertilisers and decreased by phosphatic manuring; the effect of nitrogen is variable. If 50 kg. of nitrogen is not removed per hectare in the leaves and a total of 100 kg. in the roots + leaves of beet, it signifies that there is insufficiency of this element: the potash of beets being less influenced, there is nothing to indicate the quantity of potash required for this plant; when less than 14 kg. of phosphoric acid is taken out in the roots of sugar beet, it is a sign that this substance is present in small quantity in the soil; for the green parts there are no precise indications. But the meteorological conditions also exert such an influence on beet that the percentages of nitrogen and potash can give no indication regarding the corresponding requirements of the soil for phosphoric acid, however, the minima limits of 0.18 % in the roots and 0.40 % in the epigeal portions can be established.

c) When, to ascertain the requirements of a soil in fertilising material, 2 plots are taken, one manured with nitrogen and the other with phosphoric acid and potash, the following rules can be used for estimation, according to the methods previously proposed by the author regarding winter wheat:— 1) If a soil lacks potash in the plots manured with nitrogen, the percentage of potash in the plants remains less than that of nitrogen, made equal to 100 ; if it is phosphoric acid which is lacking the ratio $\frac{\text{nitrogen}}{\text{phosphoric acid}}$ in the plots manured with nitrogen is more than 100 ; if this ratio in the plots manured with phosphates and potash is less than 100, the soil lacks nitrogen.

2) The conclusions are more certain when the ratios $\frac{\text{nitrogen}}{\text{potash}}$ or $\frac{\text{nitrogen}}{\text{phosphoric acid}}$ are equal to 100 on the plots with both phosphatic and potassic manure, because the meteorological factor is thus, as far as possible, eliminated ; then, on the plots manured with nitrogen, a ratio $\frac{\text{nitrogen}}{\text{potash}}$ less than 60 indicates a lack of potash ; if, on the other hand, this ratio exceeds 60 it indicates that there is sufficient potash; a similar ratio of less than 40 for phosphoric acid indicates that it is insufficient and above 40, that it is sufficient.

The indications would be clearer if, instead of 2 plots, 3 were taken (manured with nitrogen, potassic and phosphatic fertilisers); the percentages noted for different cultivated plants would thus enable the state of fertility of a soil to be estimated.

Whether a general value can be attributed to such observations further experiments alone can decide ; until this method has been perfected, accurate manuring experiments still remain the normal procedure for determining the fertiliser requirements of a soil.

604 - **A Critical Study of Pot Fertiliser Experiments.** — LIPMAN C. B., and LINHART, G. A. (Proceedings of the National Academy, of Sciences of U. S. A., November 1920), in *the Chemical News and Journal of Physical Science*, Vol. 122, No. 3180, pp. 137-138, London, March 24, 1921.

WAYNICK, SHARP and LIPMAN had already demonstrated that owing to the great variability of soils and of plants, fertilising experiments of long duration cannot be of much practical value, if the factors of variation and probable error are ignored.

For this reason, LIPMAN and WAYNICK began, in January 1919, a systematic study by statistical methods of the results of the pot fertiliser experiments carried out at the Ohio and the Pennsylvania Agricultural Experiment Stations.

Since the work would possibly be some time in the press, the authors deemed it wise to present a few of their most important conclusions. They draw attention to the fact, that the originators of the experiments saw the value of replicating check pots, but did not recognise the importance of such replication for the fertilised pots, which renders it difficult to subject their data to statistical treatment. Fortunately, however, the long series of years during which the pots were studied gives a replication of each kind.

The authors arranged the data respecting the experiment pots into 8 groups according to the fertiliser ; then they studied the effect of the fertiliser on each crop in the rotation, although they consider that the rotation study included in these experiments, which were themselves expensive, inadequate, and fallacious, only served to complicate a situation which was already sufficiently difficult.

The data from the pot experiments at the Ohio Station, when worked out according to the statistical method showed that:

1) The " one-element " fertilisers produced no significant increases in yield over the yields obtained from the check plots. All statements to the contrary must be regarded as erroneous.

2) The " two-element " fertilisers gave definite increases in yield over the check plots; but whether the increases are profit-yielding still remains to be determined.

3) The same may be said for the " three element " fertilisers.

4) Different combinations of the same fertilising element seem to have produced no differences in the results.

5) The amount of fertiliser used seems likewise to have been without significance.

6) Even when fertiliser experiments are properly planned, and the results adequately studied by statistical methods, our present knowledge of the enormous variability of all soils and plants renders the data from any given fertiliser plot of value only on that plot. This important consideration renders it highly probable that no fertiliser experiment as ordinarily conducted is possessed of sufficient practical vaue to justify the large expenditure of money, time and energy involved.

Having delivered themselves of this very severe criticism, the author declare, that they are not desirous of making a fetish ôf the application of statistical study to fertiliser experiments, but wish to show, that if statistical methods are not applicable to the evaluation of fertiliser experiments, the latter must be accounted of even less value and significance than the authors have accorded to them.

605 - **The Effect of Manure-Sulphur Composts upon the Solubility of the Potassium of Greensand.** — MAC CALL, A. G. (Agricultural Experiment Station, College Park Md), in *Journal of the Association of Official Agricultural Chemists*, Vol. IV, No. 3, pp. 374-376, Washington, February 15, 1921.

The recent work directed to increasing the availability of the phosphorus in floats by the solvent action of composts of manure and sulphur (1) suggested the idea of studying the effect of the said composts in rendering more assimilable the potassium present in greensand (2). Two series of composts were prepared for the purpose, with greensand containing 5.9 % and 1.4 % of potassium respectively. For each series, in addition to the control, the composts consisted respectively of: flowers of sulphur — sulphur and half-decomposed manure — sulphur, manure and sandy-clay soil — sulphur, soil, traces of sulphate of aluminium and of ferrous sulphate — sulphur, manure, soil and a small quantity of calcium carbonate. Each test was carried out in a glazed pot kept in the greenhouse (water being added to one-half the water-holding capacity), and the soil was aerated every week. Water extractions with samples of 75 gr. were employed for the determinations; the extractions were made at the beginning of the experiment, and once a week during the 23 weeks the experiment lasted.

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(1) See *R.* 1919, Nos. 24 and 603.

(2) A more or less ferruginous hydrated silicate of potassium. (*Ed.*)

In the case of the composts consisting of greensand, manure, and soil in different proportions, a perceptible amount of the potassium of the greensand was rendered soluble in water through the process of "sulphofication" (oxidation of sulphur), the most efficacious being the compost of equal parts of sulphur and manure On the other hand, in those composts where part of the manure was replaced by soil, the acidity and the amount of sulphur oxidised, and consequently also the potassium dissolved, were decreased. When soil was entirely substituted for the manure, the sulphofication proceeded so slowly, that only a minimum amount of potassium was found in the water extract The addition of sulphate of aluminium and of ferrous sulphate in no way stimulated sulphofication, whereas calcium carbonate exerted a stimulating effect at first, but it did not succeed in increasing the acidity and the soluble potassium beyond the maximum attained by the corresponding composts containing no calcium carbonate. A much larger *total* quantity of soluble potassium was obtained from composts containing greensand with a high potassium content, although a larger *percentage* of potassium was yielded by green ands with little potassium In composts containing manure, the amount of potassium recovered in the water extracts varied from 9.1 % to 41.3 % of the initial content.

In conclusion, the accumulation of soluble sulphates closely paralleled the development of acidity, and in every case, with the increase in acidity and the accumulation of sulphates, there was a corresponding increase in the amount of potassium in the water extract. The potassium, however, continued to increase for some weeks after the acidity and sulphates had attained their maximum.

606 – **The Variability of Plants Grown in Water Cultures.** — DAVIS, A R (College of Agriculture, University of California), in *Soil Science*, Vol XI, No 1, pp 1-31, 12 figs. Bibliography of 15 works Baltimore, January, 1921.

Much emphasis has, of late years, been placed upon the water-culture method as a means of determining the influence of salt upon plant-growth. The differences in the salt content being relatively small, the question arises whether fixed values can be assigned to differences of such degree when the material being compared shows extensive variation, more especially as usually the number of plants used in water-culture experiments is very small: from to 1 to 6.

For these reasons, the author has taken as his basis SHIVES extensive work (*Physiol Res.*, I, 327-397, 1915) on the physiological balance in nutrient media. SHIVE used a three-salt solution in three different concentrations having the osmotic pressure of 0.1, 1.75 and 4 atmospheres. In these the partial molecular concentration of salts was varied in increments of one-tenth, 36 different combinations resulting. As the author wished to make a statistical experimental study based on the frequency distribution of certain data, it was desirable to have a sufficient number of variants to permit of an approximately normal distribution about the mean. For this purpose, it was enough to consider a few well-chosen combinations of the 36 1.75 atmosphere solutions, which were called provisionally, following SHIVE's example, optimum, average and minimum solution respectively according to their growth efficacy. They had the following partial molecular concentrations.

Solution	Monopotassium phosphate	Calcium nitrate	Magnesium sulphate
Optimum	0.0180	0.0052	0.0150
Average	0.0036	0.0026	0.0400
Minimum	0.0072	0.0130	0.0150

A sufficient number of replicate cultures are also necessary: two series were set up for each concentration, one of 33 cultures of 5 plants each, and the other of 50 cultures of 6 plants each. In these cultures, wheat of high germination was grown and after 7 weeks the dry weight of the epigean parts was determined in the ordinary way.

The variations exhibited by plants of both series was of considerable magnitude, being approximately 20 % on either side of the mean for culture weights, and about 50 %, when individual plants were compared. When results were plotted in the form of frequency curves, the variation was of such extent, as to show considerable overlapping for the three solutions in question. Further, the arithmetic means of the optimum and medium solutions of the first series were practically the same, thus showing no significant difference in the growth efficiency of the two solutions; in the second series, an apparent difference was shown, but always within the limits of the probable error, which made it of no importance. The total and partial means of one series also varied to a noticeable extent.

It is seen from what has been hitherto said, that plants grown in culture solutions exhibit considerable variability. Indeed, this is of such magnitude, as to cast serious doubts upon the practice of drawing conclusions from the means of relatively few cultures. Since it is a question of living organisms, which are of a very varying nature, it is necessary not only to ascertain the degree of variation from a sufficient number of data, but also to determine the probable error; only thus is it possible to compare and estimate the effect of differing environments, or external agents, upon plant development.

In comparing the relative growth efficiency of different culture solutions, the probable errors of the means compared must be fixed, and as the mean of few cultures can have but little accuracy, a large series must be used, unless large differences are being compared. Moreover it could hardly be said that there is an optimum of culture in the actual conditions of experiment, for the limits within which are found conditions favourable to growth efficiency are relatively wide.

Finally, it is most important in the comparison of culture solutions, that seed of known parentage should always be employed.

607 - **The Hydrogen-Ion Concentration of Certain Three-salt Nutrient Solutions for Plants.** — MC CALL A. G. and J. R. HAAG (Department of Soil Investigations, Maryland Agricultural Experiment Station), in *Soil Science*, Vol X, No. 6, pp 481-483. Bibliography of 5 works, figs. 1. Baltimore, December 1920.

Until quite recently, practically all of the nutrient solutions used in the study of plant-nutrition problems have contained four, or more, salts in addition to a trace of iron. But in 1915 (1) SHIVE showed, that it was possible to make a satisfactory nutrient solution in which all of the essential ions, except iron, were derived from the 3 salts, calcium nitrate, magnesium sulphate, and monopotassium phosphate. Later, LIVINGSTON and TOTTINGHAM suggested 6 possible combinations of 3 salts which would give the 6 essential ions.

Type I	*Type II*	*Type III*
Calcium nitrate	Calcium nitrate	Monocalcic phosphate
Phosphate monopotassium	Potassium sulphate	Potassium nitrate
Magnesium sulphate	Monomagnesium phosphate	Magnesium sulphate

Type IV	*Type V*	*Type VI*
Monocalcic phosphate	Calcium sulphate	Calcium sulphate
Potassium sulphate	Potassium nitrate	Monopotassium phosphate
Magnesium nitrate	Monomagnesium phosphate	Magnesium nitrate

The Division of Biology and Agriculture of the National Research Council (United States) appointed a special Committee to organise a movement for the cooperative study of plant nutrition problems. In order better to correlate the work of the co-operating scientists, this committee formulated standardised methods to be adopted, and provided each cooperator with a printed copy of directions in which the preparation of the 6 type solutions is given in detail. In connection with this work, the authors have been using (in sand culture studies), solutions of types I, III and V, and it occurred to them to correlate the relative growth rates of the plants with the hydrogen-ion concentration of the nutrient solutions.

It was found by the determinations made, that in general within any one type of solution, the hydrogen-ion concentration is a function of the volume-molecular proportion of the di-hydrogen phosphate salt present, the types containing monopotassium phosphate having a lower hydrogen-ion concentration than those containing either monomagnesium or monocalcium phosphate. It further appears, that the sulphate and nitrates play only a minor part in determining the reaction of the nutrient solution. The variations in plant growth, within any one type of solution, cannot be correlated with differences in the hydrogen-ion concentrations of the solutions.

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(1) See preceding Art No. 606. (*Ed.*)

608 - **Are Vitamines Necessary for the Growth of plants?** (1). — LUMIÈRE, A., in the *Comptes rendus de l'Académie des Sciences*, Vol. 171, No. 4, pp. 271-273. Paris, July, 26, 1920.

Certain biologists have maintained that vitamines are necessary for the growth of plants (BOTTOMLEY, *Proceedings of the Royal Society of London, Biological Science*, 1914, p. 237; MOCTHERIDGE, *Ibid.*, 1917, p. 508; AGULHON and LEGROUX, *Comptes rendus de l'Académie des Sciences*, vol. 167, 1918, p. 597; LINOSSIER, *Comptes rendus de la Société de Biologie*, April, 1919 and March, 1920) and this opinion, generally admitted moreover, is derived from experiments of which the author by no means contests the results, but the interpretation of which docs not seem to agree either with other facts or with the numerous tests made by him personally in this field.

Not only can certain micro-organisms and fungi be cultivated in chemically definite media without any trace of vitamines, but it is also possible to ensure the growth and complete development of higher plants with nutrient solutions which are purely inorganic.

MAZÉ (*Annales de l'Institut Pasteur*, March, 1919, p. 139) has shown that maize can accomplish its complete evolution in a liquid containing 15 elements, all organic matter bring excluded. It is hardly conceivable that certain plants, ranging from micro-organisms up to the most complex plants, can live and grow in mineral media, while others require vitamines for their development. The idea of the utility of vitamines in the cultivation of mushrooms is due to the fact that the authors who have upheld that thesis have used very poor, insufficient media, such as a mixture of ammonium tartrate and glycerine the addition to which of a few drops of an infusion of raisins will considerably improve the nutritive value of the broth.

If the minute quantity of material thus added includes vitamines, it also contains salts, proteins and carbohydrates, and it seems improper to conclude, *a priori*, that the effect noted is due to one rather than to others of these substances. The author has stated that a great number of definite chemical products, inorganic and organic used in minute proportions, would give the same results as those obtained by the addition of the infusion of raisins, and sometimes they even gave better results; all these substances cannot be considered as vitamines.

Beer yeast heated to 135° C. for one hour, that is to say, which has lost all its antiscorbutic properties, can be used to prepare broths which favour considerably the growth of mushrooms grown in poor solutions having for basis ammonium tartrate and glycerine.

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(1) See No. 593 of this *Review*.

By methodically exhausting the yeast with alcohol, or by precipitating its extracts with phosphotungstic acid, the isolation of the vitaminic principles can be arrived at and it is thus possible to obtain, on the one hand, the exhausted yeast having no longer any curative effect on avitaminosis and, on the other hand, an extract containing the active vitamines; the latter, evaporated and then mixed with water does not improve the nutritive properties of suitable artificial media; it is sometimes rather injurious to growth, whilst the decoction of the residual yeast heated to 135° C. and deprived of its vitamines by this treatment can confer qualities which allow of a slightly more abundant growth.

By filtering organic liquids through fullers' earth to remove the vitamines, it is found that the filtrate deprived of these substances is more favourable to the growth of mildews than the liquid before its filtration.

Finally the author satisfied himself that organic extracts also, heated to about 250° C. up to the point of carbonisation, preserved their fertilising properties when they were added to a tartro-glycerine medium, and it is difficult to admit, in this case also, that the vitamines were able to withstand this temperature.

Vitamines are substances indispensable to life, which cannot be replaced by definite chemical compounds, precipitable by phosphotungstic acid and the reagents of the alkaloids; they are retained by filtration through fullers' earth and are destroyed by heat. Now, none of these properties is found in the substances which are capable of improving the nutritive qualities of poor media for plants. Therefore it does not seem proper to compare these substances with vitamines of which they do not possess any of the characteristic properties.

609 – **Reduced Acidity in Oranges Caused by Certain Sprays.** — GRAY G. P., and RYAN, H. J., in *Monthly Bulletin of the Department of Agriculture, State of California, Chemistry Number* Vol. X, No. 1, pp. 11-33, tables 29. Sacramento, California, Jan. 1921.

Report of experiments carried out with fruit picked from sprayed and unsprayed orchards. Laboratory tests were made on single fruits to show the extent of variation of individual oranges from the same tree or orchard.

The results of these tests were both surprising and convincing. No consistent difference was noted in the sugar content of sprayed and unsprayed fruits, but a remarkable difference was noted in the acid content. A discussion of the preliminary tests made at Berkeley is presented first, followed by that of the large scale sampling and testing carried out in Los Angelos County.

The data recorded at Berkeley on Valencia oranges, over ripe, indicate a distinct difference in the acidity of the comparative lots and the highest acidity of any sprayed orange is considerably less than the lowest of the unsprayed fruits.

The unusual ratios shown in the table follow as a natural sequence of practically unchanged Brix readings, but reduced acid percentage, the latter being on an average 0.32 % for sprayed and 0.76 unsprayed. The results of the tests on Valencias taken in March, before the groves had fully ripened, did not show such a remarkable reduction in acidity of the sprayed fruits as that of the previous season's crop which had hung on the trees many months after becoming fully ripe but nevertheless there is a striking contrast' (average:— 0.67 % sprayed to 1.06 % unsprayed).

With Early Navels, there appears to be no indication of any effect on acid content early in the season The average of all sprayed fruits tested is, in fact, about $^1/_5$ of 1 % higher than that of the unsprayed lots. Later on, however, the acid content of navels is reduced, as shown by tests taken in May and June (Average for sprayed 0.375 %; for unsprayed 0.871 %, etc.).

The results of the large scale tests confirmed without exception those obtained at Berkeley, and proved that certain sprays composed of lead arsenate, sulphur, and soap powder (soap and sodium carbonate) appear to be in unstable equilibrium, that is, changes in chemical composition may take place depending upon various conditions and when applied to orange trees, even for one season only, produce a marked, and in many cases a startling decrease in the acid content of the fruit, although no consistent change in sugar content.

The results obtained, including the percentage of anhydrous citric acid, and official ratio, are tabulated, comparing samples from sprayed orchards with samples from previously fumigated orchards. The juice obtained from each fruit was also measured.

The effect on lemons appears to be similar to that on oranges, although insufficient data were obtained to warrant a positive statement. Specimens of lemons from 8 groves were examined, 4 from sprayed and 4 from unsprayed groves.

Subsequent to the co-operative experiments with the Fruit Growers Supply Company, two lots of Valencia oranges were received for analysis, one sprayed with acid lead arsenate *only*, and one sprayed with basic lead arsenate and lime sulphur. An unsprayed lot was also analysed for comparison purposes: The average acidity % in fruit from the first mentioned was 0.72; from the second 0.90 and from the unsprayed 0.94.

This reduction in acidity amounts therefore to approximately 50 % of the normal acidity of fully-ripe oranges, but in many cases is much more, especially when left on the trees beyond the usual cropping time.

610 - Line Selection of Wheat at the Phytotechnological Station "La Moncloa," Madrid.

— *Estación Central de Ensayo de Semillas, Boletín trimestral,* Year I, No 1, pp 2-7, figs. 24 Madrid, March, 1921.

The phytotechnological Station "La Moncloa" commenced its work of improvement of cultivated plants by following the methods and technique of the phytotechnical Station of Svalöf.

A beginning was made with wheat and with a series of investigations with the object of facilitating the selection of local kinds by isolating and propagating the best pure lines. On account of the very great number of local varieties and also the desirability of dealing only with the zone where the physical conditions (of soil and more especially of climate) of the environment are similar to those found at the Station, the work was restricted to a small number of indigenous wheats, mostly from the two Castiles. These were the following varieties: — " Candeal de regadío " of Alfaro (Logroño), " Candeal de secáno " of Alfaro (Longroño), " Candeal de la Sagra " (Toledo), " Toledo sin barbas " (Toledo), " Toledo con barbas " (Toledo), " Candeal de Guadalajara," " Sagreño " (Guadalajara), " Candeal blanco de Zamora," " Candeal de gluma blanca" (Badajoz), and " Candeal fino " (Ciudad Real).

Each variety was sown in a special plot and, at harvest time, 25 ears were selected in each plot, establishing for each the density calculated according to the formula $D = 10 \frac{a}{l}$ where a is the number of grains in the ear and l is the length of the rachis in cm.

Table I contains the biometric data relating to the variety " Toledo con barbas " (awned Toledo).

TABLE I — *Data relating to the wheat " Toledo con barbas."*

Serial number of the ears	Length of the rachis in cm.	Number of grains in the ear	Density	Serial number of the ears	Length of the rachis in cm.	Number of grains in the ear	Density
1	12.50	41	33	14	14.00	40	29
2	14.40	57	40	15	14.00	53	36
3	13.00	48	37	16	14.50	48	33
4	13.00	47	36	17	13.00	47	36
5	13 70	53	39	18	13.00	55	42
6	12.70	54	43	19	12.50	51	41
7	14.00	48	34	20	13.70	47	34
8	13.50	54	40	21	14.50	55	38
9	14.00	60	43	22	15.00	53	35
10	14 00	50	36	23	14 00	42	30
11	14.50	47	32	24	13 00	54	42
12	14.50	53	37	25	13.60	55	40
13	14.50	55	38				

As can be seen in Table I, 15 density values (29 to 43) were obtained for the 25 ears examined. If " Toledo con barbas " represented a homogeneous group of individuals (elementary species of JORDAN, pure line of JOHANSSEN), the ears of average density (D = 36) ought to be most numerous and those of extreme density (D = 29 and D = 43) ought to be the least numerous. Representing diagramatically the values of density and of frequency, a simple curve is obtained with a single apex. On the other hand, if the varieties examined are not pure lines but populations, that is to say, mixtures of pure lines, instead of a single maximum frequency there would be more then one maximum. The curve of the diagram, instead of showing a single apex, would be broken and show separate apices increasingly numerous in proportion as the population is more heterogeneous. This is exactly the case with "Toledo con barbas" (see Table I)· There are two well defined maxima corresponding with densities 36 and 40 which, if reference is made to the law of GALTON, should be considered as the average density values of two *good* elementary species. The ears with a density of 36 and 40 (seven in all) were selected as founders of new pure lines of "Toledo con barbas."

So far as the distribution in frequency of the character "density of ear" is concerned in the other wheats, we have:—

TABLE II. — *Characters of the pure lines.*

Original varieties or populations (place of origin in brackets)	Isolated lines	Character of « density of ear » for lines isolated in 1919-1920
Candeal de regadío . . . . [Alfaro (Logroño)]	Moncloa No. 1	33
	» No. 2	35
	» No. 3	39
	» No. 4	40
Candeal de secáno . . . . [Alfaro (Logroño)]	Moncloa No. 5	34
	» No. 6	35
	» No. 7	37
Candeal de la Sagra (Toledo)	Moncloa No.	35
	No. 9	40
Toledo sin barbas. . . . . (Toledo)	Moncloa No. 10	26
	» No. 11	28
	» No. 12	37
Toledo con barbas . . . . (Toledo)	Moncloa No. 13	36
	» No. 14	40
Trigo Candeal . . . . (Guadalajara)	Moncloa No. 15	22
	» No. 16	24
Sagreño (Guadalajara)	Moncloa No. 17	35
Candeal de Arevalo . . . . (Avila)	Moncloa No. 18	32
	» No. 19	36
Candeal de Soria . . . . (Soria)	Moncloa No. 20	28
	» No. 21	29
	» No. 22	36
Candeal blanco . . . . (Zamora)	Moncloa No. 23	37
	» No. 24	40
Candeal de gluma blanca . . . . (Badajoz)	Moncloa No. 25	81
	» No. 26	92
Candeal fino (Ciudad Real)	Moncloa No. 27	35

"Trigo candeal de regadio," 4 maxima corresponding to densities 33, 35, 39 and 40.

"Candeal de secáno," 3 maxima :— 32, 35, 37.

"Candeal de la Sagra," 2 maxima :— 35 and 40.

"Toledo sin barbas," 3 maxima :— 26, 28 and 33.

"Candeal de Guadalajara," 2 maxima : — 22 and 24.

"Sagreño," 1 maximum :— 35 (this is therefore a very homogeneous variety).

"Candeal de Arévalo," 2 maxima :— 32 and 36.

"Candeal de Soria," 3 maxima :— 28, 29 and 36.

"Candeal blanco," 2 maxima :— 37 and 40.

"Candeal de gluma blanca," 2 maxima :— 81 and 92.

"Candeal fino," 1 maximum .— 35.

The ears corresponding to the maxima values are set apart for sowing separately in plots so as to constitute, as noted above, the founders of other pure lines.

The results of selection are given in Table II.

The author intends to continue the work of line selection and to extend it to other indigenous varieties, which will contribute in a large measure to the improvement of Spanish wheats by rendering them more homogeneous and heavier producers.

611 - **The Improvement of Wheat and Oats by Selection, and by Crossing Combined with Selection, in the United States.** — HAYES, H K. and GARBER, R J, in *The University of Minnesota, Agricultural Experiment Station, Bulletin* 182, pp. 1-44, 10 figs. St. Paul, Minn. March 1919.

The work carried out at the Minnesota Experiment Station with a view to improving agricultural plants may be divided under 3 heads:

1) Introduction of new varieties and types.
2) Pure line selection, or mass selection.
3) Crossing followed by selection.

INTRODUCTION OF NEW VARIETIES AND TYPES. — New introductions are essential, in order to obtain the best material for experiments, further, the time and trouble necessary to the production of a new variety adapted to a certain locality is wasted, if the same result can be obtained through introductions.

The head selection method is used, from 50 to 200 heads being selected the first year. Non-promising sorts are eliminated in the field. The next year, three systematically distributed plots of a single 18-foot row are each grown for selection, one foot being removed from each end before harvest. Those that are not eliminated, are tested the third year in three plots of three 18-foot rows each, the central row only of each plot being used for the yield test. Border rows are grown to obtain more accurate data on lodging and to overcome competition between other sorts grown near.

Selection was begun with the F_2 of a cross The seed of each plant selected in F_2 is planted in a separate plot in F_3. Some plots are homozygous for all characters, some are heterozygous for some characters and homozygous for others, while some show segregation as in F_2.

Selection by the individual plant method is continued until many homozygous forms are obtained. These are isolated and treated afterwards as selections, all rogues or inferior individuals being weeded out.

SELECTION AND CROSSING — WINTER WHEAT. — There are three main reasons why it is preferred to spring wheat:

1) It allows for a better distribution ot labour on the farm.
2) It matures earlier, which serves to protect it from rust and drought.
3) It yields more grain per acre

On the other hand, winter wheat suffers much from the cold, which kills many of the young plants, leaving gaps in the fields, so the acreage is small.

Many new varieties have been introduced and tested, as for instance, those chosen by LEIGHTY which had proved very resistant to cold in the Eastern States, but in Minnesota were only equal, or inferior, in this respect to Turkey wheat, a variety that is not noted for winter hardiness.

In short, the experiments proved that the various introductions were less hardy than the selection and crosses made at the Minnesota Experiment Station many years ago.

Of the pure lines that excelled in hardiness mention should be made of Odessa I-01-3, Big Frame I-06-6, and two semi-hardy types, Turkey I-03-120 and Padui I-03-229 (the latter is a selection from a winter wheat introduced from Russia). Crimean (Minnesota 845) has also given a good record as a hardy variety.

As regards other characters, the four (semi-hardy) Odessa selections Odessa I-01-3, I-15-179, I-15-177 and I-15-190 deserve special mention for their resistance to lodging.

The Odessa × Turkey crosses gave excellent results. They showed all sorts of recombinations of the characters of the parents, some being very hardy, others intermediate, while others again were very susceptible to cold. Data ot this sort corroborate the observations of NILSSON-EHLE and show that winter wheat hardiness is due to the interaction of numerous inherited factors.

The following Table gives the summarised data:

Variety	Nursery Series No.	Minnesota No.	Average yield bushels per acre	Average winter injury
Odessa	I-01-3	1471	2 089	38 %
Turkey	I-03-120	1481	2 471	40
Turkey × Odessa	II-02-195	1505	2 627	29
Turkey × Odessa	II-02-280	1507	2 344	42
(?) × Turkey	II-02-519	—	2 600	—
Crimean	—	845	2 056	37
Turkey	check	1487	1 549	73

Some of these hardy hybrids were also very productive, indeed tests proved that types excelling in hardiness generally excel in yield. Lower temperature appears to be the chief exterior factor affecting the yield of winter wheat.

Spring Wheat. — Rust-resistance is the most important character of spring wheat. The object of selection is to combine in the highest possible proportions the two characters of high specific yield, and resistance to rust.

Recent studies of the biology of *Puccinia graminis Tritici* have revealed the existence of several biologic forms of the parasite which can only be differentiated by their reaction to pure lines of wheat. This fact makes it difficult to obtain rust-resistant varieties by means of selection and crossing, until further investigations have been made as to the life-history of the parasite.

It is therefore best for the present to give the preference to early maturing wheats which escape the attacks of the cryptogam.

As regards selection by pure lines Marquis occupied the first place.

Several crosses made in 1908 between Turkey Winter and Wellman's Fife are better than Haynes Bluestem, and Minnesota 169; none however seem of more value than Marquis. Minden, a selection belonging to the Arnautka group, has given evidence of being a valuable sort for Minnesota.

In 1916, the following yields were obtained:

Variety	Average yield bushels
Mindum	16.6
Kubanka, Minn. n° 990	11.0
Marquis	12.7
Preston	6.2
Minnesota n° 169	5.8

Oats. — Selection by pure lines has shown that it is possible by this means to get really valuable commercial varieties. Excellent results were obtained with Sixty Day: one pure line I-17-72 was more productive than the original variety and resisted lodging better.

Selections of the following varieties deserve further testing: Minota, Garton 473, Garton 784, Scottish Chief, Irish Victor, Lincoln and Kherson.

612 - **The Improvement of Barley by Pure Line Breeding, and Crossing Combined with Selection, in Minnesota, United States.** — HARLAN, H. V. and HAYES, H. K., in *The University of Minnesota, Agricultural Experiment Station, Bulletin* 152, pp. 1-44, 10 figs., St. Paul, Minnesota, March 1919.

PURE LINE BREEDING. — Especially interesting results were obtained with the Manchuria variety: of the many lines selected, I-16-2, has given a low yield during the years that it has been tested, while the yield of

I-15-2 has always been very high. Nearly as wide variations are found within a variety as are obtained by comparing different varieties. This shows what can be attained by means of pure-line breeding alone.

Crosses Manchuria × Lion. — Lion is a smooth-awned, black barley, the former character is very important. The hybrids also are smooth-awned, and though they do not generally give as high a yield as Lion, yet as a rule, the crops are satisfactory. Several of these crosses, when compared with Manchuria No. 105 and No. 154, seemed very promising as they combined the good qualities of the latter with the character of smooth awns.

Two crosses between Lion and Mariout were tried in 1917 and 1918. Both gave high yields, but lodged rather badly; they have however the dense heads of Mariout and the smooth awns of Lion. Thus, smooth-awned barley of any head type can be produced by crossing and subsequent selection

Cross between South African and Manchuria — South African is a dense-headed type resistant to lodging, but with a very small yield. Table I gives the comparative results for the South African parent and Minnesota No. 154 (a pure-line Manchuria selection).

TABLE I. — *Comparison of yielding capacity of South African and one of the best selections of Manchuria.*

Variety	Minn. N°	Nursery series number	Year	Yield
				gm
Manchuria	184	I-01-67	1902	471.7
»	184	I-01-67	1903	621.0
»	184	I-01-67	1904	465.3
Average . . .	—	—	—	**519.3**
South African	99	I-97-3	1902	306.0
»	99	I-97-3	1903	241.9
»	99	I-97-3	1904	304.5
Average . . .	—	—	—	**284.1**

These figures show that South African is a poor yielding variety. In spite of the manifest inferiority of one of the parents, characters of some value are found in the hybrids. Thus, II-16-47 and II-16-77 are not only much more resistant to lodging than Manchuria but also excel the latter in yield (from 1916-1917, the two hybrids produced respectively 56.3 bushels and 51.1 bushels per acre).

ELIMINATION OF INFERIOR MATERIAL. — The 63 selections studied at the Minnesota Agricultural Station, together with the numerous crosses and introduction of new varieties, provided ample material for selection, and increased the possibility of fresh combinations, but in the end, this enormous accumulation of material hindered the work of definitively isolating the best types. It was therefore necessary gradually to discard all types, sorts and groups of interior quality, or that had already served their turn, and were of no further use.

After a series of severe comparative tests made for the purpose of overcoming, as far as possible, all discrepancies arising from soil heterogeneity, the series that survived was as given in Table II.

The last of these selections, Highland Chief, has been discarded as it lodges badly. This leaves 7 varieties, all six-rowed sorts, that will be further tested in field plots. All the two-rowed varieties gave less satisfactory results; but the hybrids Bohemian × Manchuria II-16-78, and 456 × Svanhals II-16-37 deserve further trial.

PRELIMINARY TEST AT SUBSTATIONS. — In 1918, several of the more promising sorts were grown in rod-row tests at the University Farm, and also at the three sub-stations of Waseca, Morris and Crookston. The averages obtained are given in Table III.

TABLE II. — *Results of Elimination.*

South African × Manchuria	II–16–47
South African × Manchuria	II–16–77
Manchuria	I–15–2
Manchuria.	I–16–66
Lion × Featherston	II–16–91
Lion × Featherston	II–16–92
Lion	I–16–13
Highland Chief	I–16–31

TABLE III. — *Results of Test at Sub-Stations (Averages).*

	Yield (per acre)
Lion × Manchuria II–16–92	46.7 bushels
Lion × Manchuria II–16–91	49.9
Lion × Manchuria II–17–11	43.3
S. African × Manchuria II–16–47	57.7
Manchuria, Minn. No. 105	57.3
Manchuria, Minn. No. 184	59.6
456 × Svanhals II–16–37	52.8
Chevalier	42.2

613 – **A New Means of Obtaining Types of Maize with a High Gluten Content.** — EAST, E. M., and JONES D. F., in *Genetics*, Vol. 5, No. 6, pp. 543-610, 8 figs. Baltimore, November 9, 1920.

Although the protein content may vary very greatly owing to climatic conditions and cultural operations, it is nevertheless sure that it is controlled by a certain number of genetic factors which, however, it has hitherto not been possible to discover The existence of genetic factors, or determinants, proves that there is every hope of obtaining by means of selection, or of crossing combined with selection, new lines, or types, possessing a larger number of factors and in such proportions, that an abundant supply of gluten may be insured.

Work in this direction has been rendered extremely difficult by double fertilisation, which takes place in maize, as in all other cereals, but with even more important consequences. The zygote is formed by the union of two gametes, ♀ and ♂, but the endosperm results from the fusion of three gametes ♀ + ♀ + ♂ which takes place at the same time. The grain is formed by successive cell division: 20 % of the protein of the maize grain is therefore found in the embryo which only transmits the inherited characters, whereas 50 % is in the endosperm which latter has no influence upon character inheritance. Let us suppose, that the differential factors of two plants, one rich and one poor in gluten, are 4 in number: A, B, C, D The formula of the plant with the high gluten content will be AA BB CC DD, and that of the one with the low gluten content will be, aa bb cc dd. The results of reciprocal crosses will be as follows. Except for a slight decrease in the amount of protein due to heterosis, the grains of the F_1 are of the maternal characters, and though they have the same formula, Aa, Bb, Cc, Dd, there will be among them some seeds that are rich in gluten, and others that are poor in gluten, according to whether the gluten content of the female parent was high or low.

On the other hand, there will be, as regards the successive generations, a very large number of possible re-combinations, which will still further complicate the work of isolating, creating, and fixing lines with a high protein content. This explains the failures that have occurred in the experiments hitherto carried out.

In the article analysed, the author gives the results obtained in the required direction by the application of a new method, viz., the artificial pollination of the greatest possible number of plants — the careful testing of the grain produced by each individual by means of the progeny-plot system — the continuation of the self-fertilisation work until the largest number of homozygote plants with gluten-containing seeds have been obtained, and the inter-crossing of these plants, for some of the hybrid, thus obtained would inherit the capacity of producing a large amount of gluten. The 4 following varieties were used: Stadtmüller's Leaming Burwells' Flint, Illinois High Protein, and Illinois Iron Protein.

Table I gives the data referring to a family of Stadtmüller's Leaming.

The examination of 27 ears (obtained by self-pollination from plant No. 14 in 1912) gave protein percentages varying from a minimum of 8.11 to a maximum of 17.86, with an average of 12.03. In 1914, the ear richest in gluten (No. 6) always produced, by self-pollination, progeny with 4 ears giving percentage ranging from 9.57 to 16.21, with an average of 13.04. The progeny of the ear which was freely exposed to cross-pollination produced an average of 11.61 % of gluten. The best ear was always chosen, and an uninterrupted series of self-fertilisations carried out until 1918, in which year the family 14-6-20-10-15 produced as a result of unrestricted pollination an average of 17.07 %.

TABLE II — *Gluten content of 7 First Generation Crosses (Stadtmüller's Leaming × Illinois High Protein).*

	Offspring										Average	Parent-Ear
A	15.86 %	14.81 %	14.36 %	14.26 %	14.22 %	14.17 %	13.71 %	13.45 %	12.81 %	12.46 %	**14.01 %**	17.98 %
B	16.50	14.81	14.69	14.44	13.59	13.29	13.04	13.04	12.07	11.61	**13.71**	18.48
C	16.32	16.14	15.78	15.52	15.47	15.14	15.04	14.99	14.88	13.09	**15.33**	16.37
D	16.38	15.29	15.08	14.69	14.21	14.10	14.02	12.64	12.41	10.57	**13.94**	9.08
E	15.92	15.48	15.08	15.17	14.94	14.63	14.49	13.86	13.68	13.30	**14.66**	15.54
F	15.13	14.89	14.62	14.59	13.95	13.69	13.38	13.36	13.34	13.23	**14.02**	15.91
G	15.55	14.57	14.54	14.52	13.96	13.55	13.52	13.28	12.42	12.20	**12.81**	10.71

TABLE I. — *Data Referring to a Family of Stadtmüller's Leaming.*

	1912	1914	1915	1916	1917	1919
Mother ear ♀	14	14–6	14–6–20	14–20–10	14–10–3	14–10–15
Protein in mother ear ♀	—	17.86 %	16.21 %	15.92 %	17.30 %	16.59 %
Extreme values of the protein in the self fertilised population	8.21–17.86	9.87–16.21	11.82–15.92	13.47–17.30	—	—
Number of ears examined	27	4	11	10	—	—
Average protein of self fertilised population	12.03 %	13.01 %	14.09 %	15.93 %	—	—
Average protein of the population exposed to cross-pollination . . .	—	11.61 %	12.69 %	15.09 %	16.75 %	17.07 %

The highest value observed was obtained in 1912, when one ear contained 17.86 % of gluten ; if however a larger number of ears had been examined, perhaps a higher figure might have been recorded. It is evident, that the commercial varieties of maize include plants with ears that are very rich in gluten and possess genetic factors which, when brought together in a homozygous condition, would give ears with a high gluten content like those obtained by mass selection at the Illinois Agricultural Station during a period lasting about 25 years. The highest percentage registered at that Station was indeed 15.66, in 1916, whereas, as has shown above, the Stadtmüller's Leaming family gave good results, as did also Burwell's Flint. On the other hand, less success was attained by selection in the case of the two Illinois varieties, which after being subjected to selection for 16 successive generations, are still in a homozygotous condition as regards most of their factors, and are hence less susceptible to modification.

One of the chief difficulties encountered in the production of lines rich in gluten by means of continued self-fertilisation is the lack of a practical method of carrying out the necessary selection operations on a large number of individuals. Theoretically all the individuals presenting extreme characters in a population should be tested, but this is practically impossible.

The author has tried to obtain at least a partial solution of the problem by crossing the types richest in gluten that had been obtained by selection combined with continued self-fertilisation. The plants of the F_1 thus obtained were self-fertilised and the progeny subjected to successive selection.

There were 37 crosses made between the families of Stadtmüller's Leaming (No. 14) and Illinois High Protein (No. 20), the gluten content of the ears thus obtained varied from 18.48 to 9.08 %. Seven of these ears (A—G) were sown in 1915. Ten ears taken from the most vigorous plants of the progeny of each of these ears were examined. The results are given in Table II.

Groups G and D gave an average even higher than that of the mother ear, but showed great individual variations. The best result was obtained from group C, which although inferior by 1 % to the female parent, manifested but slight variations ranging from 16.32 to 13.99 %. The ear with the highest protein content was chosen from each of the 7 groups and the seeds were sown in 1916. The plants thus obtained were again freely intercrossed; by this means 2 ears with 18 % of protein, and a large number with over 17 % were obtained (F_2).

Ten carefully-chosen ears were sown in 1919, and some of these were self-fertilised. The analytic data referring to these self-fertilised ears show such a high correlation between parents and progeny, that it is impossible to entertain any doubt as to the influence of heredity (see Table III).

TABLE III. — *Comparison between gluten content of parents* (1916) *and of their offspring* (1917)

	C 23 × *B* 20	*A* 26 × *B* 2	*A* 22 × *B* 2	*D* 27 × *A* 15	*B* 20 × *D* 15
Average for 2 parents in 1916 .	18.26 %	17.39 %	16.90 %	16.89 %	16.82
Average for offspring in 1917 . .	**16.31**	13.43	14.12	11.65	**15.42**
	B 2 × *A* 4	*A* 36 × *D* 10	*A* 20 × *D* 21	*A* 10 × *D* 2	*B* 41 × *A* 26
Average for 2 parents in 1916 .	16.67 %	16.53 %	6.04 %	15.98 %	15.93 %
Average for offspring in 1917 .	13.09	12.86	**15.05**	12.83	12.37

After 7 years of work, 3 types of maize were obtained with respectively 16.31, 15.42, and 15.05 % of gluten, which were also vigorous and gave fair yields of grain.

Further, each of these types still possess a reserve of variability, which renders possible further improvements. The two ears highest in gluten content from family C 23 × B 20 were planted in 1918. From the offspring of one of these plants, the 15 selfed ears obtained averaged 17.68 % gluten, and one reached 20.14 %.

Gluten content is due to a large number of inherited factors; and various strains having the same percentage composition probably differ in respect to their genetic composition, so that it is possible to obtain a number of genetic factors that are superior to those of its parents, and hence a still higher gluten content.

614 - **The Explanation of Heterosis in Maize.** — COLLINS G. N., in *The American Naturalist*, Vol. IV, No. 637, pp. 116-133. Lancaster Pa., March-April 1921.

A stimulation of growth has come to be recognised as one of the results of hybridisation. This phenomenon is of so much importance both practically and theoretically, that it has been given a special designation, *heterosis*.

TABLE I — *Number of F_2 individuals necessary to provide an even chance of obtaining at least one individual homozygous for the number of dominant characters indicated in Column I.*

Number of dominant homozygous characters	Number of characters involved													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	11	5	3	2	2	1	1	1	1	1	1	1	1	1
3	—	45	14	7	4	3	2	2	2	2	2	2	1	1
4	—	—	178	45	19	16	6	4	3	3	2	2	2	2
5	—	—	—	710	150	54	26	14	9	6	5	4	3	3
6	—	—	—	—	2 480	516	165	70	35	20	13	9	7	5
7	—	—	—	—	—	11 400	1 820	516	199	94	49	29	19	13
8	—	—	—	—	—	—	44 900	6 520	1 760	584	246	123	68	41
9	—	—	—	—	—	—	—	182 000	23 400	5 500	1 770	700	322	165
10	—	—	—	—	—	—	—	—	726 000	85 400	18 400	5 490	2 030	870
11	—	—	—	—	—	—	—	—	—	2 900 000	313 000	62 600	17 400	6 000
12	—	—	—	—	—	—	—	—	—	—	11 600 000	1 160 000	215 000	56 000
13	—	—	—	—	—	—	—	—	—	—	—	46 500 000	4 320 000	750 000
14	—	—	—	—	—	—	—	—	—	—	—	—	186 000 000	16 150 000
15	—	—	—	—	—	—	—	—	—	—	—	—	—	744 000 000

Heterosis is shown to a special extent in maize , in nearly all the commercial varieties of the latter, individuals manifesting this abnormality are to be found, and these abnormal plants are almost always deficient in vigour and yield. Heterotic variations are recessive, but when the dominant character is eliminated by continued self-pollination, these anomalies show themselves, and influence the development and yield of the plant.

Different varieties possess different groups of recessive lethal, or semilethal, characters In a cross between two varieties, the negative characters common to one parent are brought into combination with, and suppressed by, the dominant allelomorphs in the other parent. Freed from the depressing effects of these recessive characters, the first generation of a hybrid is usually more vigorous and productive than either parent; this explains the phenomenon of heterosis.

One of the objections to this hypothesis is that; if this explanation is correct, it should be possible to obtain an occasional F_2 individual homozygous for all dominant allelomorphs, the progeny of which should be uniformly as vigorous as the F_1 and so far, this individual has not been found.

The probability of finding such an individual is indeed very small, as can be seen by referring to Table I (page)

On the other hand, an examination of the maize literature, and the biometric data directly obtained by the author, in no wise exclude the possible existence in the F_3, and even in the F_2, of hybrids with vigorous growth.

Height is probably the most satisfactory character to use as a measure of heterosis. There are 29 comparisons of F_1 and F_2 populations (23 made by Emerson and East, and 6 by the author) : in these 29 cases, the mean of the F_2 was below that of the F_1 in every instance, but in 10 of the 29 cases, the largest of the F_2 plants equalled, or exceeded, the largest of the F_1 plants.

Similar observations were made respecting length and diameter of ear and length of internode : as regards the last character, 5 of the F_3 individuals were superior to the F_1, whereas none of the F_2 equalled the F_1

The second objection brought forward was ; that a series of independent dominant characters influencing size would bring about an asymmetrical (skew) distribution of the F_2 individuals.

All the cases observed have, on the contrary, shown perfectly symmetrical distribution, but it should be noted that the number of individuals used in the construction of a diagram would have to be very large in order to make departures from a normal frequency distribution apparent.

In fact, with 20 pairs of characters (giving 21 classses), 514 627 776 individuals would be required to obtain a representative population; 99.91 % of this population would fall into the 12 classes with the largest number of dominant characters. Therefore, in order to obtain any individuals smaller than those represented in these 12 classes, populations of over 700 would have to be grown. With ordinary-sized populations, the distribution would be fairly represented by these 12 classes (see Table II).

TABLE II. — *Distribution of* F_2 *individuals, classed according to size.*

Number of dominant allelomorphs	Proportion of individuals
9	0.3
10	1 0
11	2.7
12	6.1
13	11.2
14	16.9
15	20.2
16	19.0
17	13.4
18	6.7
19	2.1
20	0.3

A distribution of this nature, with populations of approximately 500 individuals representing the highest classes (9-20) conforms to the normal frequency curve as closely as would be expected.

The asymmetry would appear if the first 8 classes were considered, but these are so little represented, that in order to determine their presence, an enormous number of individuals have to be examined.

Thus the two chief objections made against the hypothesis which has been employed to account for heterosis fall to the ground, and in no way affect the truth of the explanation.

615 - **The Improvement of Tobacco by Hybridisation and Selection in Sumatra.** — JOCHEMS, S. C. J., in the *Mededeelingen van het Deli Proefstation te Medan*, 2nd Series, No. XIX, pp. 1-25. Medan, 1921.

Results of work on the improvement of tobacco, carried out at the Medan Station (Sumatra), in two ways, viz., hybridisation followed by selection, and selection by pure lines.

HYBRIDISATION. — Study of descendants of the cross *light line* No. 1 × *dark line* No. 72 in order to individualise and isolate a hybrid with constant characters. The results have again been negative; the descendants were never homogeneous and intermediate gradations were met with.

The data collected lead to the following conclusions :—

1) The percentage of dark leaves is higher in most of the hybrids than in *line* I, and the percentage of light leaves is less than in *line* 1.

2) The percentages observed in the hybrids differed very slightly from those of *line* 72.

3) Among the few hybrids which can be considered as superior, the *line* No. 2155, which furnished a tobacco superior to *line* 1 (Consortium of Deli), should be noted.

Data relating to the F_2 *and* F_3.

Line	Cross	Generation	Dark leaves per cent	Light leaves per cent	Intermediate leavesper cent.
2184	72 × 1	F_2	58.4	18.7	22.5
2144	»	F_3	30.9	45.3	23.4
2223	»	F_3	41.6	27.9	30.1
2174	»	F_3	33.5	37.0	29.1
2267	1 × 72	F_3	37.0	31.5	31.0
2229	»	F_3	31.4	46.7	21.5
2231	»	F_3	30.5	31.1	38.0
2233	»	F_3	38.1	37.3	24.1

4) In the Soenger Bahasa plantations, the *hybrid* 2225 proved superior to *line* 72 · in the Goenoeng Rinteh plantation No. 2229 stands first.

5) It has not so far been possible to isolate a hybrid with really constant characters.

Crosses between the lines 1 and 774 (many leaved) are also under study; the data collected so far do not yet allow conclusions or forecasts to be formulated.

PURE LINES. — The study of these continues, with favourable results in the case of lines 774, 976, 542 and 553.

616 – **The French National Wheat Committee.** — HITIER, H, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VII, No. 4, pp. 77-83. Paris, Jan 26, 1921.

In April, 1920, M. J. H. RICARD, the French Minister for Agriculture, instituted the National Wheat Committee with the general object of examining all means tending to increase the production of wheat and proposing all measures likely to ensure their application.

The author reviews the results obtained in 1920 by the National Wheat Committee, through the work of its sections dealing with:— *Technique, competitions, corporate action, and propaganda.* Departmental Committees, in collaboration with Directors of the Agricultural Services, Offices and Agricultural Associations, organised seed fairs, sorting sheds, wheat growing competitions, etc. Up to the present, the results satisfy the object aimed at by the creation of the National Committee and there is every reason to predict that its scope will be still further widened during 1921.

To this end, M. RABATÉ (General Secretary of the Committee) presented to the Committee, on December 18, 1920, a programme of work which was approved and, among other things, has in view the following measures:—

A general inquiry regarding the present adaptation of various varieties of wheat to the geological, agricultural and climatic conditions of various parts of France. Study of the tillage of fields under wheat and subjecting to regular controlled experiments the operations at present recommended, not always with sufficient discernment and knowledge of the very varied conditions of agriculture in France Cultivation of wheat in spaced lines with second ploughing, earthing-up, etc. Multiplication of wheat competitions in the different Departments. Development of co-operative societies for agricultural tools, apparatus for threshing and sorting seeds, and more specially a new form of association, namely, co-operative seed production, grouping 10, 20, 30 of the leading farmers of each canton, having at its disposal a genealogical selection farm and a central depot for sorting and despatch. By means of control over standing wheat crops and over threshing it would be possible to deliver one or two varieties with a maximum guarantee.

M. CHASLES, President of the French National Association of millers, has initiated an organisation of this kind in the Seine-et-Marne district.

In all parts of France progress in the cultivation of wheat can be made, but to obtain results quickly, efforts must be brought to bear on those parts which cultivate the largest areas under wheat, because they possess land suitable for the crop ; and it is necessary, in the whole of those regions, to endeavour especially to improve the cultivation in those which give the smallest yields. M. RABATÉ has compiled an interesting table dealing with this point. After having determined the average figures of areas in hectares and of yields in quintals for the period 1905-1914, he calculated for each Department the coefficient obtained by dividing the number of thousands of hectares sown with wheat, by the yield per hectare. The higher the coefficient so obtained, the greater is the relative effort of improvement required.

By perusing this table both the efforts to be made and the results which may be hoped for can be ascertained, in regions such as that of the west (Maine-et-Loire, Vendée, Loire-Inférieure, Ille-et-Vilaine) sowing over 140 000 ha. of wheat in each of these Departments without obtaining an average yield of 14 quintals per hectare ; and such as that of the south-west (Lot-et-Garonne, Dordogne, Gers, Haute-Garonne, Charente, Charente-Inférieure, etc.) sowing over 110 000 ha. of wheat and obtaining a yield of less than 12 quintals per hectare.

617 - **Experiments with Wheats from the Swiss Jura at the School of Agriculture at Cibeins (Ain, France).**— SCHRIBAUX, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol VII, No. 13, pp. 330-332 Paris, Apr 1921.

Since 1918 the author has repeatedly induced farmers in regions in France where the winter is severe and where the high yielding wheats recommended do not stand the hard frosts, to sow the varieties of Swiss Jura wheat selected by M. MARTINET, Director of the Seed Testing Station at Lausanne (Switzerland). In the note reviewed he brings to notice the good results obtained by M. BLÉRIOT, Deputy-Director of the École Municipale lyonnaise d'Agriculture at Cibeins (Ain), with the two varieties " Bretonnières " and " Vuitebœuf " which confirm results previously obtained by other experimenters.

On poor soil, sown as late as November 26, 1919, the following yields were obtained :—

Vuiteboeuf	1568 kg. of grain per hectare
Bon Fermier	1328 » »
Carre Vaudois	1300 » »
Montcalme	1187 » »
Mottet de Savoie	1110 » »

Bretonnières was, by mistake, threshed with another variety, so it is not possible to give the yield; but from the look of the crop on the field it must have been equal, if not superior, to the Vuitebœuf wheat.

In 1919 and in 1920 the author found at the "Ferme des Colonies étrangères" at Champagne and at the Experimental Farm of Noisy that Vuitebœuf and Bretonnières compared favourably with Japhet, Gros-bleu, Bordeaux, and Noë for yield, quality of grain and earliness, and that they had a great advantage over the last two varieties in being resistant to rust.

The author considers that the Swiss Jura wheats improved by M. MARTINET can be tried with good prospects of success throughout the whole of France, excluding the zone of the olive where they would be liable to scorching.

618 – **Notes on the Cultivation of Oats in France.** — VILCOQ (Director of the School of Agriculture at Chesnoy, Loiret), in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VII, No. 18, pp. 434-437. Paris, May 11, 1921.

The land, belonging to terrace sands and gravels and which had borne a crop of wheat in the previous year, was first ploughed to a depth of 15 cm. about February, followed at the time of sowing, by the application of 400 kg. of $^{13}/_{15}$ superphosphate per hectare, and scarifying and scutching. The seed was sown in lines 15 cm. apart, and each variety studied occupied a plot of one-fiftieth of an are.

The oats tried in the experimental crops of M. VILCOQ and the yields obtained, were as follows :—

	Yield per hectare in quintals
VILMORIN Hybrid	11
Victoire	18
SCHRIBAUX 1st hybrid (Ligowo × Brie) (1)	19
SCHRIBAUX 2nd hybrid	20
Grey oat of Houdan (or of Beauce)	21
Pluie d'or	22

The hybrid oat Ligowo × Brie gives a first class grain and very abundant straw. For light calcareous soils a hybrid of SCHRIBAUX, the grey oat of Houdan and the Pluie d'or have shown themselves superior to the other varieties for quality of grain, hardiness, and yield.

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(1) See *R.*, May, 1920, No. 507 (*Ed.*)

The author has thought that, for the calcareous soils of Gâtinais, it would be interesting to cross the grey oat of Houdan with the Pluie d'or, so as to preserve the quality of grain of the former whilst improving considerably the proportion of straw. He has been working on this problem for two years. By cross-fertilisation he has obtained a new hybrid which he is at present studying.

619 – ***Zea Mays dentiformis* var. *leucoceras*, a New Variety of Maize from French Guinea.** — RAYBAUD, L., in the *Comptes rendus de la Société de Biologie*, Vol. LXXXIV, No 15, pp 796-797 Paris, April 30, 1921.

The author has received a new variety of maize from French Guinea, where it is called " niogoué, " and has tried to acclimatise it in Provence. It is characterised by its flattened grain pointed at the upper end and by its white colour. It corresponds to the *Zea Mays dentiformis* var. *crococeras* of KÖRNICKE, but is white instead of yellow and is intermediate between the maize with sweet wrinkled grain (*Zea Mays saccharata*) and the dent maize properly so-called (*Zea Mays dentiformis*). Grown in Provence, this variety formed ears that were more cylindrical than conical, 17-22 cm. long and 5 cm. broad, composed of a dozen rows of grains. Out of some fifty varieties studied by the author the characters " spacing of rows " and " compactness of ears " are more pronounced in this variety than in others. It is also remarkable on account of its very fusiform leaves.

Sown in Provence in April this variety was not harvested until November.

620 – **Results of Experimental Cultivation of " Reggiano " Maize (Early Dwarf)** (1).— SUCCI, A., in the *Giornale di Agricoltura della Domenica*, Year XXXI, No. 13, p. 99, figs 3. Piacenza, March 27, 1921, and the *Gazzetta agraria*, Vol X, No 7, p. 1, 2 figs Alessandria, Apr. 15, 1921.

Experimental cultivation which has been carried out all over Italy has brought to notice that the " reggiano " maize of Reggio Emilia is the earliest and most dwarfed of all, and that, of equally early kinds, it is the most productive. The data contained in the two following Tables show the results of experiments made in 1920 at Parma by the Technical Office for the Production and Selection of Seeds and at Forli by the Agricultural Office of the Royal Laboratory of Agricultural Chemistry.

Results of the cultivation of maize at Parma.

Kinds	Field of Castel S. Martino		Kinds	Field of Cornacchia	
	Grain per ha. in kg.	Order of earliness		Grain per ha. in kg.	Order of earliness
Alfredo Strampelli . .	4250	2	Reggiano (SUCCI) .	2700	1
Luisa Strampelli . .	4200	4	Bergamasco . . .	2650	—
Reggiano (SUCCI) . . .	4200	1	Tito Poggi . . .	2450	late
Principe Potenziani . . .	3900	5	Piacentino	2400	—
Saverio Strampelli . . .	3750	3	Cremonese	1950	—

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(1) See *R.*, 1918, No. 409. (*Ed.*)

Results of the cultivation of maize at Forli.

Kinds	Yield of grain per hectare in kg.	Average weight (in kg.)	
		of each entire plant	of each ear without spathe
Reggiano	3 518	0.495	0.132
Local yellow	3 228	0.825	0.151
Luisa Strampelli	2 900	0.570	0.057
Saverio Strampelli	2 520	0.355	0.070
Principe Potenziani.	2 133	0.610	0.080

621 – **Types of Maize with a High Gluten Content.** — See No 613 of this *Review*

622 – **Cultivation of Rice in Ceylon.** — I Summers, E, The Tillering of Ceylon Rices — *The Tropical Agriculturist*, Vol LVI, No 2, pp 57-86, pl. 6 + Tables 19 — II Bamber, M K., Paddy Manuring Experiments with Yala Crop, 1920 *Ibid*, pp 87-90 Peradeniya Ceylon, Feb 1921.

The observations here described are intended to throw light upon the question of the average number of ears per acre to be expected in the following 3 cases — 1) when the seed paddy is broadcasted in the ordinary ways; 2) when single plants are transplanted at intervals of 6 × 6 in.; 3) when the seeds are sown at intervals of 12 × 6 in.

The data given refer to various varieties grown at the Experiment Station, Peradeniya in 1920.

I. Broadcasted Paddy. — Results indicate that in a paddy crop broadcasted, weeded and thinned out by the methods normally employed by the Ceylon cultivator: 1) most of the plants in the crop will have either one or two good ears; 2) if more than 2 ears are borne on a plant the chances are that one of these will be immature and worthless; 3) the average number of ears per plant to be expected from the crop is 1.9; 4) if the plants are separated on an average by a distance of 22 in., each square yard will contain 220 plants, and should therefore produce about 418 good ears. These results have been checked in the field, chiefly with Central Province fields of Hatiel, Heenati and Mawi. These were found to be conformed to in all cases.

II. Transplanted Paddy. — By transplanting the seedlings at intervals of 6 × 6 in., a square yard contains $^{1}/_{9}$ of the number found when the crop is broadcasted.. It follows therefore that on an average, the plants must produce, if there is no increase in the average size of the ears, 9 times as many ears as the broadcasted plants, if the yield is to be maintained. The varieties used were a series of 3 months paddies grown in the experimental plots at the Dry Zone Experiment Station at Anuradhapura. The series comprised 90 varieties of which 52 were exactly duplicated at the Peradeniya Experiment Station. The seed samples were collected from all parts of the Island about the middle of 1919. A striking feature of all plots was the almost entire absence of weeds so that no weeding was necessary from start to finish. Progress was excellent at Anuradhapura, many of the varieties being harvested within 76 days from the time of transplanting or within 110 days from the time of sowing. The results obtained in the case of 44 Ceylon varieties are tabulated in full, with a view to serving as a guide to cultivators in the future in connection with what results may be expected with a particular variety as regards the number of tillers when transplanted alike. It is concluded thereby that the increased yields obtained by transplanting are not entirely due to increased tillering on the part of the seedlings.

A comparison of results at Anuradhapura and Peradeniya is rather surprising in view of the fact that the fields at the former station are only 3 years old, the drainage is good and the mud not at all clayey. On the contrary the fields at the latter station are old, clayey and the drainage inferior. The view is generally held that in the case of dry cultivated cereals, a sandy soil encourages tillering, while a soil rich in clay has the reverse effect. In these experiments there was not the slightest evidence that this is true for the rice plant, so that evidently caution should be taken before attempting to apply to paddy, the results obtained with dry cultivated cereals.

During the Yala season of 1920, in an attempt to elaborate a system of field technique for pure line work at Anuradhapura, the plan was tried of sowing the individual seeds by hand directly upon the paddy field. In all, 69 pure lines were thus sown, but the results have not yet been worked out in every case. Sowing took place on June 2 and 3, 1920, with varieties varying from 6 to 4 months old.

Most of the plants appeared to possess tiller numbers lying between 5 and 15, although a fair number had from 16 to 20 tillers. There was no more variation of the tillering mean between the different varieties than there was amongst the means of the lines of any single variety, nor was anything in the nature of a specific tillering capacity observed.

As regards the yield and development, the following general comparison may be made between broadcasted and transplanted paddy :

Broadcasted	Transplanted
1) Number of ears produced is a minimum.	Number of ears produced is greater.
2) Tillering is irregular	Tillering is more regular and can be expressed by a definite tiller mean.
3) Development of the aerial portion of the plant is small.	Aerial portion develops vigorously.
4) Root development is greatly restricted.	Root development is very great compared with broadcasted plants.

It appears as though it is necessary to furnish adequate space to the plant during the first two months of its growth, if root development is to be maximum.

II. Owing to the urgent necessity of increasing food production, several paddy manuring experiments were arranged by the Agricultural Society for the Yala crop in 1920. The chief objects were to ascertain :—

1) Whether Ephos phosphate could be usefully employed to replace bone meal, the common paddy manure, as at that time the latter was very scarce and very expensive; there was a possibility of the export of bone meal from India being stopped altogether;

2) to try the effect of Nitrolim as a source of nitrogen for paddy.

The following mixtures were employed:

No I	Fish Guano	70 lb.	containing nitrogen	8 8 lb.
	Ephos Phosphate	80 »	and phosphoric acid	29 6 »
	Nitrolim	18 »		
No. II	Bone meal	120 lb.	containing nitrogen	6.16 lb.
	Nitrolim	25 »	and phosphoric acid	24.64 »
No III	Ephos phosphate	100 lb	containing nitrogen	4.0 lb.
	Nitrate of potash	40 »	phosphoric acid	30 0 »
			and potash	13.2 »

The manures were to be well mixed with their bulk of soil and applied broadcast after the second ploughing, and before mudding and levelling. No change was to be made in the method of cultivation adopted in each district. It was proposed to cover the cost of the manures from the crop after harvest.

The following is a summary of the results of the manuring received up to the present time:—

	Yield per acre			
	Mixture I	Mixture II	Mixture III	Control
	bus.	bus.	bus.	bus.
Kandy District	30	$28^{2}/_{5}$	25	25
Udispattu, H. B. Rambukwella	22	19 (+2 light)	20 (+2 light)	
Girihagama	23	20	24	
Dunuwila Fields	32	—	—	24
Mavilmada	24	20	15	20
Colombo	28	30	25	12
Ratnapura	26 (also 28)	32	—	

Before the Maha crop which is grown between October and February, a new series of plots was arranged in different parts of Ceylon, some 45 in all. The general plan was to have 4 plots of approximately 1 acre each to be cultivated by the usual methods, but thoroughly, and treated as follows:—

1) Green manure at 2 000 lb. per acre and 1 cwt. Ephos phosphate; 2) fish guano 84 lb.+ Ephos phosphate 100 lb. + nitrolim 40 lb.+ (13.5 lb. nitrogen + 37.14 lb. phosphoric acid; 3) control; 4) sterilised animal

meal 112 lb. + sterilised bone meal 56 lb. nitrogen 10.1 lb. + phosphoric acid 19.8 + potash 6.3 lb..

Most of these plots are now under cultivation but several were started very late owing to the lateness of the N. E. rains in the districts concerned and in a few cases the plots have been partly ruined by heavy floods.

The harvest will be made between February and April.

623 - **Mechanical Cultivation of Rice Fields** (1). — RINGELMANN, M., in the *Journal d'Agriculture pratique*, Year 84, No. 31, pp. 94-95, figs. 1 Paris, July 29, 1920.

In Louisiana, U. S. A., rice has been harvested since 1884 with binders constructed for harvesting cereals (wheat, oats, barley, rye) except that the driving wheel is wider and its rim furnished with angle pieces projecting 8 to 10 cm. so as to enable the wheel to grip soil which is still moist at the time of reaping, although the rice fields are drained some days before the machine is taken in. This practice, which exists in Burma where reaping is done by hand, apparently gives better results than those obtained when the rice is reaped in water as is the practice in Indo-China. The object of the great width of the driving wheel is to prevent the machine from sinking far into the soil. In Italy the ordinary wheel of the binder has been replaced by a sleigh bearing a small internal-combustion engine which actuates the mechanism of the machine which is drawn by a team, (*Journal d'Agriculture pratique*, 1912, vol. 1, No. 26, p. 814).

In 1893 in Louisiana the binders were usually drawn by 4 oxen yoked in pairs and 2 mules in front; threshing was done with heavy traction engines and threshing machines as used for wheat.

The use of this machinery, which made possible an increase in the area under rice with the same available labour force, had the following results reported in 1893:— The first binder was employed in Southern Louisiana in 1884; in 1885 there were 5 machines and the number was increasing; 50 binders were in use in 1886, 200 in 1887, 400 in 1888, 1500 in 1890, 2000 in 1891, and 3000 in 1892. These figures show the extension of rice cultivation in Louisiana due to the use of machinery and are verified by the following figures:— The Southern Pacific Railway Co. transported in 1886 one thousand metric tons of rice; this special traffic increased regularly and reached 150 000 tons of rice in 1892.

This and further information, expounded by the author in his special lectures on Farm Engineering applied to Colonial needs, given at the Ecole nationale supérieure d'Agriculture coloniale at Nogent, induced some of his former pupils to study the modifications required in rice cultivation in the French Colonies.

M. ALAZARD made conclusive tests in Indo-China for the Indo-Chinese Rice-growers' Association; after his experiments on the mechanical cultivation of rice fields, he harvested with an ordinary binder without any modification; at the time of reaping, the ground was fairly dry, so that there was no fear of the machine sinking in the field, and he considered that even a heavy tractor (4 to 5 metric tons) could draw the binder.

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(1) See *R.* June 1920, No. 680, *R.* Oct. 1920; *R.* May 1921, No. 491 (*Ed*)

Official tests of mechanical ploughing were made in Cochin-China in 1917; the results were unfortunate owing to the poor choice of the apparatus used, to its mechanical build, and its great power to which much importance was attached under the pretext of being able to work on a wide track, whereas it is preferable to use a light tractor, to decrease the width of the tract, and to increase the pace.

For the mechanical ploughing of rice fields, the author believes that a tractor of the GRAY type should be tested but with a 20-25 HP engine, with front wheels having rims 30 cm. wide and providing these wheels with iron discs so as to transform them into drums, which in soft soil, cause less resistance than when the spokes of the wheels are uncovered.

624 - **Mechanical Sowing and Weeding of Rice by the Cabrini-Mocchi Method** (1). — TARCHETTI, A. and CHIAPPELLI, R., in *Il Giornale di Risicoltura*, Vol. XI, No. 2, pp. 21-26. Vercelli, Feb 28, 1921.

The method invented by CABRINI and which he improved in collaboration with MOCCI, both of Pavia, has spread at the present time over a large area of the provinces of Pavia and Milan The Royal Lombardy Institute of Science and Literature awarded him the prize offered " to the person who should invent or introduce in Lombardy a new machine, any industrial process or any other improvement from which the inhabitants obtain real and proved benefit ».

The " R. Stazione di Risicoltura " at Vercelli tested the CABRINI-MOCCHI method in 1920.

Eighty-five ares of old rice field were divided into 4 equal plots, two of which were sown broadcast on May 15 (one with " Originario " seed and the other with " Onsen ") and the other two, on May 17, with the seeder (with the same two kinds of seed respectively). Medium sized machines were used, namely, a seeder and an 8-row weeder, 2.40 metres long. From the first period of growth onwards the rice sown with the seeder was seen to have more uniform growth, fewer blanks, and especially a much smaller and less vigorous growth of weeds.

On June 15, the first cleaning and weeding was made. It was not possible to carry out the second cleaning with the machine; it had to be done by hand. In spite of this there was a saving of about one-third in the labour employed in cleaning, and cleaning required only 200 hours work per hectare as against 293 hours per hectare for cultivation in the ordinary manner. The saving would have been much greater had it been possible to execute the second cleaning also with the machine. In the plots cultivated according to the CABRINI-MOCCHI method there was scarcely any lodging, whereas it was very considerable in the control plots. In the former the crop was finer and probably superior by about 30 %.

The authors recommend that the labour up to the present employed on weeding the rice should be transferred to transplanting, and that the rice fields should partly be cultivated in the CABRINI-MOCCHI method and partly by transplanting. This is possible as the operations of cleaning and transplanting take place at the same season.

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(1) See *R.* Apr. 1919, No 457. For further details see the *Giornale di Risicoltura*, 1915, No. 12; 1916, No 6 - 1918, Nos. 10 and 11; 1920, Nos. 2, 3, 4, 5, 6, and 7. (*Ed.*)

CABRINI and MOCCHI offer their help to farmers who wish to experiment with their method. They also offer the use of their machines and accept as their fee half the increase in yield obtained with their method.

625 - **Notes on Adlay (*Coix Lacryma-jobi* var. *mayuen*) in the Philippines.** — WESIER, P. G. Agricultural Advisor, Bureau of Agriculture) in *The Philippine Agricultural Review*, Vol. XIII, No 3, pp. 217-222, pl 4 Manila, 1920.

One of the most interesting economic plants once important, but now allowed to fall into the background is the adlay, *Coix lacryma-jobi* L. var. *mayuen* Stapf., a form with soft hulls and very distinct from the ordinary *C. lacryma-jobi* with hard, bead-like shining grains.

The author gives a brief outline of the distribution of adlay in India, China and the Philippines and, with reference to the last mentioned, he reports the results obtained in Zamboanga from seed obtained in Bukidnon. In 1918 a small plot 5 × 6 metres was sown with adlay in the early part of July and harvested in the new year. After an allowance of 10 % was made for possible errors due to the small area, the yield was calculated at the rate of 3625 kilos per hectare of which 2610 kilos was hulled, clean grain, or 72 % of the total weight. In 1919, 257 sq. metres were sown at the Lamao Experiment Station. This plot yielded at the rate of 1634 kilos of grain and 4319 kilos of air dried straw per hectare. This low yield is, however, believed to be due to the fact that the seed was not sown until early August, and not transplanted until September.

The analysis of adlay from Bukidnon made by the Bureau of Science is shown in the following Table, which for comparison shows the analysis of various grains and pulses.

Samples	Moisture	Protein	Fat	Ash	Crude fibre	Carbohydrate starch etc.
	%	%	%	%	%	%
Edible adlay (whole grain)	10.02	8.23	8.87	8.94	14.08	49.86
Hulled adlay .	10.91	11.27	6.65	1.89	0.45	68 83
Wheat. .	10.62	12.23	1 75	1.81	2.36	71.18
Maize	10 93	9 88	4 17	1.36	1.71	71.95
Oats. . .	10.06	12.15	4 33	3.46	12.07	58.75
Rice. . .	11.88	8.02	1.96	1.15	0.93	76.05
Millet .	11.66	9.25	3 50	2 35	7.29	65 95
Pea	12.40	20 68	1.31	2.88	4.21	58.52
Beans .	15.25	19 63	1.72	3.29	3.54	46.57
Mungo . .	9.21	18.30	0.88	4.23	4.89	62.49

For comparison with the Philippine adlay, the following analysis of hulled adlay grown in India is given: moisture 13.2 %; albumen 18.7 %; starch 58.3 %; oil 5.2 %; fibre 1.5 %; ash 2.1 %.

According to the observations made in the Philippines adlay grows well at sea level up to an elevation of at least 1000 metres (in India it is grown up to an altitude of 1500 metres). The plant requires a moderate rainfall during the growing period but is not injured by heavy rains, provided the land is well drained It does best on a somewhat friable, loose, fairly rich loam, and should not be planted on heavy, clay soil.

From the preliminary experiments made in the aforementioned districts, it would appear that in field culture, adlay should be sown in June, July and early August, so that the plants have the benefit of the rainy season, and can be harvested during the dry period Four to 5 seeds should be planted per hillock, the hillocks being 40 to 60 cm. apart in rows 70 to 80 cm apart.

After germination the field should be cultivated and hoed as for maize. Later further cultivation is found to be unnecessary.

When the grain is ripe, the stalks should be cut from 60 to 75 cm. from the top, tied in bundles, dried, and subsequently threshed and cleaned like other grains. The tender plants make good forage for cattle and horses, and for this purpose, the seed should be sown in drills and not on hillocks as in the former case.

In a broad sense, adlay cannot hope to supplant rice and maize in the dietary of the people in the Archipelago, but the author considers it a feasible proposition to use it to take the place of the said grains partly as stock feed and for poultry. Considering its reputed breadmaking qualities, the possibilities of native grown adlay as a wheat substitute is worthy of careful study, especially taking into account the fact that the value of wheat flour imports exceeded the imports of rice which in 1919 amounted to 8 817 362 pesos (1).

Owing to its cultural adaptability to a wide region of the Philippines, and the many and varied uses to which the grain may be put, and its apparent productiveness, which, however, requires verification, adlay should certainly not be disregarded, and deserves a thorough investigation.

The plates illustrate the variability in construction and yield.

626 - **Adaptation of the Cultivation of Cotton on Sandy Soils in Egypt** (2). — MARGOS, D. P., on the *Bulletin de l'Institut d'Égypte*, Vol II, Session 1919-1920, pp 1-8. Cairo, 1920.

The author states that in sandy soil on the border of the Egyptian desert he has succeeded, by annual pruning and by grafting Egyptian varieties on American arborescent cotton plants *Gossypium barbadense* L. in obtaining shrubs which live for some fifteen years and produce a cotton comparable with that of the best native kinds (Sakellaridis).

This process of cotton cultivation has the following advantages: — 1) Utilisation of sandy soils of small value; 2) heavy yield and early harvesting; 3) rational and effective remedy against cotton pests (*Gelechia gossypiella*); 4) invariable preservation of the qualities of the fibre; 5) facility in producing the varieties desired; 6) no difficulty in preventive treatment against any eventual attack of parasites (winter treatments); 7) resistance to drought; 8) economical plantation and upkeep, since the work is done mechanically and the cost of plantation does not recur for 10 to 15 years; 9) reduction in the cost of production per unit owing to increase in the yield (10 to 15 quintals of raw cotton per hectare from the second year with a maximum of 35 quintals towards the 8th year with subsequent insignificant variations).

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(1) 1 peso = 50 c (U.S.)

(2) See *R.* Apr. 1921, No. 328. (*Ed.*)

The rotation for such a method of cultivation would be:— one third of the property under cotton, one third under permanent irrigated pasturage and one third under various crops (groundnuts, lupins, chick-peas, sesamum, potato, barley, millet, etc.).

627 - **Curua Palm Oil from *Attalea spectabilis* in Brazil.** — *Bulletin of the Imperial Institute*, Vol. XVIII, No. 2, pp. 172-174. London, April-June 1920.

The fruits forwarded to the Imperial Institute from Brazil for analysis, averaged 2.5 in. in length, 1.5 in. in diameter and had an average weight of 35 gm They bore at the apex a spike about ½ in. long and at the base papery leaf-like bracts. The husk or pericarp which was brown and fairly smooth on the outside enclosed a light brown nut with a very hard shell about ¼ in. thick. The kernels averaged 1 in. in length, 0.8 in. in breadth and 4.8 gm. in weight.

The fruits were identified at Kew as those of *Attalea spectabilis* Mart. They closely resemble cohune fruits (*A. Cohune*), except that the kernels of the latter are blunt at both ends.

The analyses showed that the pericarp contained % moisture 11.1; fat 2.9; fat (expressed on dry pericarp) 3.3, and the kernel, 4.3 moisture, 62.5,fat and 65.3 fat (expressed on dry kernels).

A comparison is made with the respective contents of cohune, oil palm fruits, and the coconut.

The kernel fat when refined would be suitable for edible purposes, and the kernels yield a considerably higher percentage of fat than palm kernels, and if available in commercial quantities should realise a higher price than the latter.

The residual meal when analysed gave the following results: % moisture 8.9; crude proteins 16.8; fat 0.1; carbohydrates 52.8; fibre 15.1; ash 6.3; and the nutrient ratio was 1 : 3.2 and food units 95. Judging from these results it is evident that curua meal is fairly rich in proteins, and should be nearly equal in value as a feeding stuff to palm kernel meal Practical trials would, however, be necessary before the kernel meal or cake could be safely recommended for general use as a feeding stuff.

628 - **The Oil of the Prickly Pear Seed.** — LOMANITZ, S. (College Station, Texas, in *The Journal of Industrial and Engineering Chemistry*, Vol. XII, No. 12, p. 1175. Easton, Pa., December, 1920.

In Mexico, an excellent hardened jelly is made from the fruit of the prickly pear. The pulp alone is employed for this purpose, the seeds being removed. The analysis of the seeds of a more or less cultivated white variety known as the orchard prickly pear gave the following results: moisture 7.68 % — ash 2.96 % — oil 10.89 %. The oil, which was obtained by extracting the seed with petroleum ether, was greenish yellow in colour, odourless and somewhat viscous at ordinary temperatures.

From the constants determined, this oil apparently belongs to semi-drying group, and if produced in sufficient quantities, might be used in some of the oil-products industries.

629 - **Seed Oil Production in Egypt.** — See No. 671 of this *Review*.

630 - **"Gonaké" (*Acacia arabica*) an African Substitute for Quebracho** (1). — VUILLET J. (Chef du Service d'Agriculture in Haut-Senegal-Niger), in *La Nature*, No. 3444, pp. 92-93, figs. 2. Paris, Feb 5, 1921.

A still little known African tanning product is "gonaké ' or "gonakie" of Senegal, "bagana" of the Bambara country, "sant" pods of the Egyptian Sudan, the pod of one of the arborescent Mimoseae (*Acacia arabica* Wildenow), whose habitat extends over the basins of the Senegal, the Gambia, the Niger and the Nile and over a considerable part of British India, where it is known as "babul".

In West Africa there are at least 2 varieties of this acacia, one wild, common on the flood zone of the rivers where it forms forests in certain places (notably the forest of Gorgol in the Senegal basin), the other propagated by the natives, a few trees being frequently met with in the interior or in the neighbourhood of villages (variety *Adansoniana* of DUBARD). The former is distinguished by its taller habit (some trees are 12 m. in height) and especially by its pods being very much constricted between the seeds. The village variety bears flattened pods, more or less curved and twisted, 6 to 15 cm. long, 1.7 to 2 cm. broad, with undulating edges, at first covered with a short whitish velvety down, becoming greyish and wrinkled when dry. This variety is seldom more than 4 to 8 m. high when full grown.

In both varieties the bark, which contains 20 to 30 % of tannin, is dark coloured and fibrous in structure.

According to numerous analyses carried out by P. AMMANN, chemist employed on industrial investigations by the Government of French West Africa, the pods of the wild variety, collected before they become dry, contain from 35 to 41 % of tannin (estimated with permanganate) Pods of the cultivated variety were found by the same chemist to contain 45 % of tannin on dry material.

Before the war, England occasionally imported from West Africa, pods of *Acacia arabica* under the designation « Gambia pods ".

Lately various experiments have been made with this product on the continent, in France, Belgium, and Italy, with satisfactory results.

Gonaké pods, used by native tanners, are sold in certain markets in the vallies of the Senegal and Niger, but only in small quantities. The author has seen them sold before the war at 0.10 fr per kg. at Nyamina, 0.05 fr. at Barouéli and 0.03 fr. at San. The trade in Senegal might form important stocks by organising the collection in wild stands, especially in the districts of Kaédi and Matam (1). Also, experiments made in the valley of the Niger, at the Agronomic Station of Koulikoro, with the *Adansoniana* variety, have shown that the tree is well suited to cultivation. It is easily propagated from seed and can be transplanted when a year old without any difficulty. It grows fairly quickly and does not require a rich soil. It seems to thrive best on clay-loam soils. Experiments made with the Indian variety on the Golconda coast, showed that salt water in the sub-soil does not impede its growth, so it could be advantageously used for reafforestation in Lower-Senegal in places where "Filao" (*Casuarina* spp.) does not succeed (2).

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(1) See *R*, Feb 1913, No 137 (*Ed.*)

In good conditions of growth, a 4-year old tree has already produced several kg. of pods; commencing from the 5th year, the average yield of a compact plantation, 6 m. by 6 m., is at least 5 kg, or a yield per hectare of 1387 kg. of pods collected before drying, but weighed dry (in drying the pods lose about 50 % of their weight).

An isolated full-grown tree, well grown, produces annually from 25 to 40 kg. of dry pods.

P. AMMAM, who has analysed the pods collected in the experimental plantation at Koulikoro, found that they contained 45 parts of tannin per 100 of dry pods and gave a light yellow solution in water and a blue black precipitate with iron salts. He is of opinion that they are an excellent substitute for sumac,

It was suggested that the cost of transport could be decreased by separating the pods from the seeds, which contain no tannin and form 32 to 35 % of the total weight of ripe pods. It is therefore usefal to note that two samples of powdered pods from Sant, containing respectively 60.9 and 54.5 % of tannin were sent for examination to the Imperial Institute in London in 1910 ("New colonial and other tanning materials", in the *Bulletin of the Imperial Institute*, 1913, No. 3) and submitted to tanners and manufacturers of extracts. The experts considered that the product would be difficult to sell in that form which is not suitable for the extraction of tannin, and the tanners prefer to use a solid or liquid extract, soluble in water. On the other hand, whole pods were considered interesting and it was stated that they might be disposed of in England at 200 fr. per metric ton.

The pods of the Indian Babal, although rich in tannin, are not generally used on the spot for tanning, as the tanning liquid prepared from them is rapidly fermented by a *Mucor*. Experiments made at the technical Laboratory of the Department of Industry of the United Provinces in India showed that fermentation could be arrested by boiling the liquid, by keeping it at low temperature, or by treating it with an antiseptic. The feeble activity of the *Mucor* in a temperate climate explains why fermentation does not prevent the use of the pods of *Acacia arabica* in Europe (*Bulletin of the Imperial Institute*, 1916, No. 4). A product rich in tannin would be obtained by collecting the pods before the seeds are formed as the latter which constitute 32 to 35 % of the total weight of ripe pods contain no tannin. Is is particularly desirable not to let the pods dry on the tree. Collected at such a time they stain the leather more or less strongly and contain a relatively small proportion of tannin.

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(1) See *Acacias à tannin du Haut-Sénegal* by J. HENRY and P. AMANN, Paris, 1913. (*Author*)

(2) See *R.*, 1919, No. 612. (*Ed.*)

[630]

631 – **The Production of Tea and the Tea Trade throughout the World, the Improvement of Old Tea Estates and Soil Treatment on Plantations.** — I. JUDGE, A S., The Production of Tea in the Empire and its Relation to the Tea Trade of the World, *Bulletin of the Imperial Institute*, vol XVIII, No 4, pp. 490-523. London, Oct -Dec. 1920. II MCKAY, J. M., Improvement of old Tea Estates, in *Tropical Life*, Vol XVII, No. 4, pp. 57-59, London, April, 1921. III. HOPE G. D, Notice sur la préparation du sol pour la culture du the, *Bulletin Economique de l'Indochine*, Year 23, No. 145, pp. 814-820, Hanoi-Haiphong, Nov.-Dec. 1920.

I. As it is of great importance at the present time that the position of the tea trade in the world should be stated and explained, the author, lately Chief Collector of Customs in Burma, here gives a summary of the prevailing conditions in each country concerned with the production of tea.

In the first place, the origin of tea is discussed and the gradual spread of tea drinking from China, where it has been a recognised beverage since the early years of the Christian era. It is interesting to note that the Japanese acquired the tea habit about the Xth century, but that it was only in the XVIIth century that it was first introduced into Europe. The author traces the spread in the United Kingdom, the British Empire, the United States, South America, Russia, Europe in general. In addition to this, Persia, Asia Minor, Arabia, Afghanistan, Morocco and North Africa are apparently now also acquiring the habit, green teas being most in demand.

TEA-PRODUCING COUNTRIES. — The following countries supply the world with tea : China, Japan, Formosa, Indo-China, India, Ceylon, Java and Sumatra in Asia, and Natal and Nyasaland in Africa. In the Caucasus, near Batoum (1), a small tea industry is in existence; it was started some 30 or 40 years ago, but has made little progress. In the United States, exhaustive experiments were made by the Agricultural Department; it was proved, however, that without plentiful and cheap labour the tea industry could not be made a paying proposition. The supply of labour is the most important question in regard to the cultivation of tea, more than twice the number of coolies being required to work a tea estate than would be necessary to work the same acreage under coffee or rubber. A large proportion of the labour should consist also of women and children for leaf-plucking. If all the leaf is not taken off when ready to be plucked, the shoots get ahead, especially in the centre of the bush, and not only is the plucking surface reduced, but the bush will not continue to " flush " so freely, and the yield is diminished.

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(1) See *R* Jan. 1912, No. 118; Dec. 1913, No. 1343; Jan 1916, No. 54, March 1919 No 323. Dec. 1919, No. 602. (*Ed.*)

As the labour question is a cause of anxiety to planters in all parts ot India, Ceylon and the Dutch Indies, the aim of the planter is to obtain the best results from the area already planted: this can be effected by improved methods of cultivation and pruning, and by gradually replacing plants of inferior " jât » (variety or strain) by those which will give the highest yield of leaf.

CHINA. — The region of greatest production lies in the coastal and interior provinces bordering and immediately south of the Yangtze-Kiang; it is in this region that the black and green teas of international commerce are produced. In Yunnan also there is considerable cultivation, but the plant grown is the large-leafed indigenous variety, and the tea produced is usely only in Western China and Tibet. In China, tea is grown in small patches, large plantations being practically unknown The finest teas are produced in April, when the young leaves and buds are covered with a white down. Only 3 or 4 pickings can be made between April and October, owing to the severity of the winter climate together with the somewhat scanty rainfall.

The leaves are picked and partially cured by members of the grower's family; they are then collected by a middleman, who subjects them to a process of firing betore sending the product in bulk to one of the large centres, where factories have been established for refiring, sorting and packing The chief centres of the tea trade are Hankow for brick and black tea, Kiukiang, Santuao and Foochow for black and green tea, and Hangchow and Ningpo for green tea. Yachan is the centre for the trade with Tibet.

In 1919 the aggregate exports from China were about 92 000 000 lb., — an improvement on the trade of 1918 which amounted to only 54,000,000 lb. The decline, as compared with pre-war exports was mainly due to the uncertain Russian market, and also to the unfavourable exchange. In 1919, over 27 000 000 lb., were sent to London, which was more than twice the average quantity shipped during pre-war years. In an effort to encourage the tea trade, the Chinese Government, in October 1919, abolished the export duty levied on all teas shipped abroad

INDO CHINA (1). — Tea has been exported in small quantities, mainly to France since 1900. In recent years the exports have amounted to nearly 2 000 000 lb. The China variety has been cultivated and the tea produced has been of poor quality. Is is stated that, in Tonkin and Central Annam, Europeans are growing tea, and as the climate is suitable and the labour should be cheap and plentiful, it will be interesting to watch the development of this industry. The large-leafed tea-plant is said to be indigenous in the hills of Tonkin.

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(1) See *R.* Nov. 1918, No 1243; April 1919, No 467, May 1919, No 601 (*Ed*)

JAPAN. — Green teas are mainly manufactured and for many years Japan has supplied America with tea; in recent years, this trade has amounted to about 35 000 000 lb.

The competition of British and Dutch grown teas in the United States is now very keen and Japanese merchants are making great efforts to retain, and if possible to extend their trade.

FORMOSA. The tea plant was introduced into Formosa from China more than 100 years ago. The cultivation is carried on, as in China and Japan, by peasant proprietors, who also manufacture the tea and sell it to central factories. The Japanese authorities have encouraged the industry and there is now a considerable export trade, which does not, however, appear to increase. Formosa Oolong teas are said to have a distinctive flavour and are very popular in the United States, where they obtain good prices. The annual exports amount to about 25 000 000 lb.

INDIA. The first sample of tea made in India was prepared in 1837 from old plants found growing on a tract of land in Lakhimpur, Assam, which had been cleared for cultivation. The tea plants and other trees on the land had been cut down and the land cultivated with rice and after the paddy had been harvested, the tea plants had thrown out young shoots and leaves. This discovery led to the cutting down of plants regularly in order to improve the quality of the foliage that was obtained for the manufacture of tea; of which about 500 lb. were shipped to England in 1838.

The principal tea districts are situated in North Eastern India, in the provinces of Assam and Bengal, and contain 84.5 % of the aggregate tea acreage in India. Tea is grown to perfection in Assam, the natural home of the plant, not only as regards quantity but also as to quality. The China plant formerly cultivated and bringing in an average yield per acre of 290 lb. has been replaced by the finest varieties of the indigenous plant raised in various seed gardens in Assam. These gardens have supplied nearly all the seed used in recent years in India, Ceylon and the Dutch Indies. The yield has been enormously increased, and the average per acre from 23 600 acres plucked in 1918 was 725 lb. There are also many estates producing over 800 lb. of fine tea per acre. Two companies, Budla Beta and Pabbojan, famed for the high quality of their produce, had in 1919 an average yield of over 900 lb, of tea per acre from a planted area of 4656 acres. There are large areas of waste land suitable for tea in Upper Assam, but future extensions must depend on the available labour supply.

In Cachar and Sylhet, excellent yields have been obtained from some of the "bheel" gardens (swamps or bog land composed often of true peat, very rich though with shallow surface soil, and an impervious subsoil) It seems, however, doubtful whether the tea plant, with stunted root developments, will have a long life in shallow soils. Tea has also been extensively planted in the plateau lands; the soils are not equal to those of Assam, and the quantity and quality of the crops are inferior to those obtained in Assam or the Dooars.

In Darjeeling, the teas are famous for their flavour All the land suitable and available in the hills has been used and no further extensions can be made. By improved cultivation, the average yield per acre is being steadily raised, and many estates produce over 500 lb. of fine tea per acre.

In Terai, tea can be produced at a fairly low cost, but the quality is not high. Mosquito blight, combined with an unhealthy climate have been the most serious drawback.

In the Dooars in the west, very high yields up to 1000 lb. per acre are obtained, and the average quality of the tea is good. There are large areas of excellent tea land available which will be brought into cultivation as the occasion presents itself.

In Southern India, China seed was planted in the Nilgiris in 1834, and for many years the cultivation on a small scale was confined to the highlands. During the present century about 30 000 acres have been planted in the said district and in the adjacent districts and about the same acreage in Travancore State The climate differs very largely from that of N. E. India, and corresponds with the conditions prevailing in Ceylon. Good yields are obtained and the quality of tea is being improved. The industry has been a success, and can be extended. Labour is not difficult to obtain.

General. The average annual production of tea in India as a whole for the 6 years 1915-19, was 375 000 000 lb., an increase of about 85 000 000. lb., over the average crops of the preceding 5 years. The crop of 1920 was a short one, owing to unfavourable climatic conditions, especially in Terai and the Dooars where the output in many Estates was from 25 to 40 % less than in 1919.

CEYLON. Tea planting was taken up only about 1875, when *Hemileia vastatrix* in an epidemic form had attacked the coffee plant. The following figures show how rapidly the industry was developed: — In 1875, The acres planted numbered 1080; in 1885, 152 000; in 1895 305 000; in 1905, 390 000 and in 1915, 409 000.

About 1904, rubber planting was taken up, and in the low country tea eventually disappeared. At the same time, however, tea continued to be planted in the highlands and during 1906-17 over 15 000 cwt. of tea seed were imported from India, sufficient to plant out 45 000 acres. In 1920 it was estimated that there were 395 187 acres under tea of which 366 678 acres were in bearing. The production was estimated at 192 500 000 lb., which works out at 525 lb., per acre. The output from the native-owned gardens was estimated at 7 818 000 lb. Dr. BERNARD who was deputed in 1912 by the Government of Java to study the conditions of the tea industries of India and Ceylon, stated in his report that the absence of terraces on the Ceylon tea estates had resulted in a serious loss of soil so that on many estates more manure had to be used than would otherwise have been necessary in order to obtain a satisfactory crop.

There is no cold weather season, the leaf is therefore plucked throughout the year, and the bushes pruned at intervals.

The following statement shows the exports of tea from Ceylon 1917 to 1920

1917 lb.	1918 lb	1919 lb.	1920 lb.
193 030 000	180 639 000	208 438 000	184 847 000

NATAL. — The restrictions placed on Indian immigrations into Natal in 1911 seriously hampered the industry, which has contracted and is being replaced by the cultivation of the sugar cane. The production of tea in 1918-19 was 1 410 000 lb. from 4136 acres, compared with an output of 2 681 000 lb. from about 4000 acres in bearing in 1903.

NYASALAND. — Tea is grown only in the Mlanje district where the soil and climate are well suited to the plant. In 1919 about 4500 acres had been planted and about 700 000 lb. of tea were exported. The tea comes into profitable bearing in the 5th year, and can be produced at a cheaper rate than in India or Ceylon.

JAVA (1). — Tea is grown mostly in the mountainous districts on the western side of the island; a large proportion of the area is cultivated by native proprietors and consists of small gardens of a few acres in extent, usually found in the vicinity of European plantations where the green leaf is sold.

Dr. G. D. HOPE, scientific officer of the Indian Tea Association, who visited Java in 1916, has written a very instructive account of the Java tea industry. He speaks in the highest terms of the excellent manner in which the Dutch planters have laid out their estates on the sides of the hills, and by terracing and planting along contour lines of the slopes, have prevented loss of surface soil by wash. He also refers to the general superiority, from an agricultural standpoint of the soils of Java, over those of N. E. India; they are richer in organic matter and nitrogen, but contain considerably less potash than Indian soils in the tea districts, which would account for the fact that the greater proportion of Java teas are of common medium description. They are, however, carefully manufactured, evenly sorted in lots or " breaks ", and put down at low cost, which appeal to the blender.

The bushes are plucked all the year round, and, as there is no fixed time for pruning, if the bushes are not regularly plucked, they get out of hand, and the yield is lowered in quantify.

It seems improbable that any large extensions will be made in Java for some time to come, but the general tendency will be to attract labour to the existing estates, and by this means obtain larger crops. Java can produce tea more cheaply than either India or Ceylon. The Chairman of the Anglo-Dutch Plantations estimated the present cost of production at 5d. per lb. The gradual rise in export trade is shown as follows: 1913, 64 703 000 lb., 1917, 80 236 000 lb., 1918, 61 853 000 lb., 1919, 110 772 000 lb. The exports to Holland were larger than the quantity required for home consumption; it is not known whether markets were found for the surplus. Java is seriously competing with Ceylon in the Australian market where tea is admitted free of duty; Java tea can be sold at from 2d. to 3d. per lb. cheaper than Ceylon teas.

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(1) See *R.* June 1917, Nos. 549 and 595; *R.* Oct. 1917, No 955; *R.* Jan. 1919, No. 17. (*Ed*)

SUMATRA (1). — Tea cultivation was introduced in Sumatra in 1910, and at the present time it is estimated that there are 20 000 acres under cultivation. The root growth of tea bushes is shallow owing to the impervious nature of the subsoil, and roots do not penetrate more than 1ft. deep. MANN in a report on the tea soils of Cachar and Sylhet remarks: .. "though the plant may be exceedingly luxuriant so long as the superabundant tertility of the surface soil lasts, it becomes after this, exceedingly subject to drought, and the quality during its whole life reveals the unnatural conditions under which it is grown".

As much as 1200 lb. of tea per acre has been produced in the 4th year after planting. The actual production of tea, however, in 1919 was 8 818 500 lb. from 13 500 acres in bearing (equal to 670 lb. per acre). Compared with Upper Assam, this is comparatively low in spite of the fact that the best yielding Assam varieties are grown and plucked all the year round and that the growth is luxuriant. It can only be attributed to shortage of labour.

The quality of the tea produced corresponds to ordinary Java teas. The export trade has increased as follows: 1917, 3 949 000 lb., 1918, 5 266 000 lb., 1919, 9 368 000 lb.

PRODUCTION AND CONSUMPTION AND THE INTERNATIONAL TRADE IN TEA. — Fifty years ago China and Japan produced practically all the tea consumed in the world. The author traces the gradual spread and quotes reliable data indicating the world's trade in 1890, 1900, 1913, and 1919, and it is interesting to compare the gradual rise and fall in the export trade and the same with the total consumption in the various countries.

Country	Exports	% of Total trade	Exports	% of Total trade	Exports	% of Total trade	Exports	% of Total trade
	1890	1890	1900	1900	1913	1913	1919	1919
	lb.		lb.		lb.		lb.	
British India.	115 000 000	23.3	176 300 000	30 0	291 700 000	37.3	371 500 000	
Ceylon .	49 000 000	10.0	149 000 000	25 3	197 400 000	25.2	208 000 000	
Java .	7 500 000	1.5	16 000 000	2.7	65 000 000	8.3	111 000 000	14.0
Sumatra							9 500 000	
Japan .	50 000 000	10 0	41 000 000	6 9	34 000 000	4.4	40 000 000	4.6
Formosa .	20 000 000	4.0	20 000 000	3.4	24 000 000	3 0	24 000 000	2.8
China (*) .	250 000 000	50.9	184 500 000	31 3	166 000 000	21.3	92 000 000	10.8
Other countries .	1 500 000	0.3	2 000 000	0.4	3 400 000	0.5	3 000 000	0.4
Total .	**493 000 000**	**100.0**	**589 000 000**	**100.0**	**782 000 000**	**100.0**	**859 000 000**	**100.0**

(*) This figure does not include 25 000 000 lb. of tea imported from the British and Dutch Indies for the manufacture of brick tea, which was re-exported to Russia.

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(1) See *R.* Jan. 1915, No. 2; *R.* Aug 1918, No. 832; *R.* Jan. 1919, No. 17. (*Ed.*)

[631]

Country	Consumption	% of Total trade	Consumption	% of Total trade	Consumption	% of Total trade	Consumption	% of Total trade
	1890	1890	1900	1900	1913	1913	1919	1919
	lb.		lb.		lb.		lb.	
United Kingdom . . .	195 000 000	40.0	247 000 000	42.0	306 000 000	39.8	388 000 000	45.1
Australia	25 000 000	10.0	27 000 000	9.2	37 000 000	11.3	46 000 000	11.8
New Zealand	4 000 000		5 000 000		8 000 000		9 000 000	
Canada	19 000 000		22 500 000		36 000 000		36 000 000	
Other British countries	—	—	—	—	10 000 000		10 000 000	
United States	84 000 000	17.0	96 500 000	16.4	95 000 000	13.0	108 000 000	12.5
Russia	90 000 000	18.0	100 000 000	17.0	190 000 000	24.2	15 000 000	1.7
Continent of Europe (excluding Russia) .	20 000 000	4.0	30 000 000	5.0	—	5.7	15 000 000	8.1
Holland	—	—	—		20 000 000		55 000 000	
Other countries	56 000 000	11.0	61 000 000	10.4	25 000 000		—	
South and central America	—	—	—	—	12 000 000	7.0	10 000 000	6.2
Northern Africa . . .	—	—	—	—	10 000 000		10 000 000	
Persia (Asia minor) . .	—	—	—	—	18 000 000		18 000 000	
Other countries in Asia	—	—	—	—	15 000 000		15 000 000	

The author closes by giving a general idea of the present condition of affairs with regard to British grown teas from the commercial standpoint.

II. — McKay who is one the most experienced of agricultural authorities in India considers that the present time is opportune to consider many aspects of the tea industry, and presents in his article a series of facts and recommendations worthy of attention.

The deciding factors as to whether or not an area ot old tea is worth renovating, or even retaining in cultivation are first, the number of bushes per acre, next the "jât" of these bushes and their condition of health. If on exhausted soil, old and sickly tea bushes are struggling to grow, and if the number of such bushes is less than 1000 per acre, the author considers it advisable to abandon the area. If the soil is moderately good and the bushes healthy, it may be wise to fill up vacancies or even to interplant between the existing lines of tea bushes. For this purpose strong 2-year old plants will be required, which should be manured the following year after planting, or preferably for 2 years.

In undertaking the renovation of old tea, the first point is to stop all further soil wastage and the only effective system is by terracing (see Java). In some cases the cost of making terraces is prohibitive, but a cheap effective means of arriving at the same result is to sow seed of a leguminous crop e. g. *Tephrosia candida* along the contour lines, and allow the plants to remain for several years in this position An appreciable terrace will gradually be formed and when the shrubs are eventually cut away, a small drain can be made at the underside of the terrace, the excavated earth thrown up, and a fresh supply of seed sown. In flat lands there is less likelihood of serious injury from soil wash, but as clayey and retentive soils are frequently met with in such situations, adequate drainage is essential. A good supply of organic matter will tend to keep these soils open and friable and green crops should be grown for this purpose. Bone dust applied at the rate of 200 to 250 lb. per acre usually will be found to encourage development of green crops.

Trenching can be adopted with advantage on old tea lands. Small drains are cut out to a depth of 18 in, and 6 to 9 in. wide and filled with prunings etc. and then the earth levelled in. The value of the work will depend on 2 main factors:

1) the length of time the trench can be left open to the ameliorating influences of the atmosphere;

2) the amount of vegetable matter that is available for burying on the trenches.

Collar pruning has often given good results but the bushes may ultimately be found to deteriorate unless this operation is accompanied by manuring and other ameliorative soil treatment.

Shade is an important factor in the health of the tea bushes. *Dalbergia* spp. and *Albizzia* spp. are suitable leguminous trees for planting among tea; these not only produce a good shade but the leaf fall has a beneficial manurial effect (1).

To bring back deteriorated tea estates to a profitable cropping condition, adequate manuring will be necessary where the bark on the branches is dry and hidebound, and where few or no young shoots are coming from below or from the collar of the bush, nitrate of soda or sulphate of ammonia applied at the rate of 100 to 150 lb. per acre will prove useful. If the soil is acid, as many tea soils are, the former is to be preferred. These manures should be applied early in the season before the heavy rains are due. (The Scientific Department of the Indian Tea Association have reported very good results in recent experiments with nitrate of soda). Phosphoric acid can be supplied by a cheap dressing of bone dust which will assist the growth of green crops and help the development of the tea bush. Potash is not much required for Indian tea soils; endless new mixtures have been recommended by various specialists, but the following is typical of many of those which have found considerable favour during the last few years:

		Nitrogen	Phos. acid	Potash
200 lb.	Fish guano.	15 lb.	17 kg	—
200	Nitrate of soda	30	—	—
100	Ephos phosphate	—	30	—
50	Muriate of potash	—	—	20 lb.

Application 550 to 750 lb. per acre.

This application refers however to tea manuring in Ceylon, but a smaller quantity of the same mixture can probably be relied upon to give profitable results in India, thus involving less expense.

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(1) Full details of the various green manures and the special advantages of each will be found in "Green Manures and Manuring in the Tropics" by P. DE SORNAY (Tropical Life Publishing Dept. 83-91. Gt. Tichfield St. Oxford st. London). (*Author's Note*).

III. — A review of the latest scientific investigations carried out as regards the proper treatment of soil relative to the cultivation of tea. From the results obtained, the author draws the following conclusions:

1) Light and sandy soils can be improved by the application of organic manure or of soil of a heavier texture. Trenching and terracing is sometimes advisable Heavy soil should be well worked, but not when in a very humid and sticky condition; improvement is effected by the addition of sandy soil.

2) The surface soil should be kept loose and friable to prevent evaporation of moisture during the cold season; for this two things are advised:— *a*) pinching off the adventitious shoots which prevent loss of water by transpiration; *b*) mulching (tea leaves are apt to transpire to a considerable extent).

As the sun's rays probably play an important part in actuating soil fertility, during the cold weather, the surface soil exposed to the sun should be kept well cleaned.

632 - **Aromatic and Medicinal Plants of Sardinia.** — MICHELETTI, G., in I. *Rivista Italiana delle essenze e profumi*, Milan, March 1921. — II. *Bollettino della Associazione Italiana pro piante medicinali, aromatiche ed altre utili*, Year IV, No. 3, pp 42-43. Milan, March, 1921.

The Sardinian flora is very rich in wild aromatic and medicinal plants, originating perhaps from species formerly cultivated as medicaments and now become wild. Among these plants may be cited: — Marsh mallow, arnica, borage, camomile, lesser centaury, hemlock, foxglove, eucalyptus, gentian, henbane, laurel, mallow, oleander, rue, elder, datura, squill, mullein, etc.

The southern coasts of Sardinia are rich in the Lycian juniper (*Juniperus phoenicea*) which yields 2 % of an essence, not comparable, it is true, with that of *Juniperus officinalis*, but nevertheless sufficiently appreciated. The island could furnish 5000 tons of the berries of this species for distillation.

On the coasts and mountains, rosemary abounds and 15 000 tons of fresh leaves could be collected yielding from 0.25 to 0.35 % of essence, as against 1 to 1.5 % for dried leaves. Myrtle is very abundant, and 30 000 tons of its leaves could be collected, which, when fresh, contain from 0.200 to 0.225 % of essence and as much as 0.35 % when dry.

The stoechas lavender (*Lavandula Stoechas* L.) is widely distributed, especially on poor soils, little suited for cultivation both in mountain and plain. It can furnish several tons of flower heads, which yield, in a fresh state, 0.2 % of essence. Wormwood is fairly wide spread throughout Sardinia, but especially in the province of Sassari.

Water-mint and penny-royal, very common along the streams and in damp places, could provide 20 000 tons of raw material for distillation with a yield in essence of 0.2 %.

Thyme is abundant in the zone of Mount Gennargentu; it yields about 3 % of essence.

Some experiments in cultivating roses for essence have given very satisfactory results.

At Cagliari there is a company (" Società Sardo-Lombarda SUBINAGHI & Co. ") which collects and manipulates Sardinian aromatic and medicinal plants, but there is still much room for similar undertakings.

633 - **Market Gardening in Italy.** — SCANO, C., in *Il Coltivatore*, Year 66, No. 36, pp. 980-983. Casale Monferrato, Dec. 1920

The author, continuing his notes on the situation of market-gardening in Italy (1) gives the following information.

ONIONS AND GARLIC. — This crop is cultivated over 6000 hectares and produces 657 500 quintals. The cultivation of onions and garlics is very evenly divided between the districts of North and Central Italy and those of the South and the islands. The largest areas are in Venice and Campania and the smallest in Emilia. The greatest production occurs in Campania and Venice and the least in Sardinia and Tuscany. The average production for the whole Kingdom is 109 quintals per hectare, with a maximum of 268 in Emilia and a minimum of 77 quintals in Venice.

ARTICHOKES. — These cover 5775 hectares and the total production in 511 000 quintals. This crop also is equally divided as regards area between the north and south of the peninsula and the production is almost equal in each. The largest areas under artichokes are in Tuscany and Sicily, the smallest in Venice and in Apulia. Tuscany has the greatest production and Apulia has the least. The average production is 88 quintals per hectare for the whole peninsula, with a maximum of 134 quintals in Tuscany and 127 quintals in Apulia, and a minimum of 57 quintals in Liguria.

CARDOONS, CELERY AND FENNEL. — The area devoted to the cultivation of these plants for the market in Italy is only 2025 hectares, and the production is 335 500 quintals. The cultivation of these pot-herbs is more extensive in the southern districts than in the north (where only 915 hectares are under these plants) but the quantity produced is about the same in the north and south. The largest areas on which they are cultivated are in Campania and in Apulia whilst the smallest area is in Sicily. Campania and Liguria give the highest production. The average production for the Kingdom is 166 quintals per hectare; the highest average production is in Liguria with 310 quintals, and the smallest in the Abruzzi, 111 quintals, and Latium, 109 quintals per hectare.

ASPARAGUS. — This occupies the smallest area of all market garden crops; the cultivation of asparagus is limited to 4 districts, 3 of which (Piedmont, Liguria and Venice) are in Northern Italy and 1 (Latium) in the Centre. Only 792 hectares are under asparagus and the production is barely 25 900 quintals.

The average production is 33 quintals per hectare; the highest average is 45 quintals in Venice and the smallest is 24 quintals in Latium.

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(1) See *R.* June 1920, No. 658. (*Ed.*)

634 - **Suggestions for the Right Selection of Apple and Pear Stocks.** — HATTON, R. B. (Wye College Fruit Experiment Station, East Malling) in *the Journal of the Royal Horticultural Society*, Vol. XLV, Pts. 2 and 3, pp. 257-277, pl. 23. London, July, 1920.

I. APPLE STOKS. — Investigations have been made at Wye College Fruit Experiment Station, East Malling with regard to the relative vigour of Free, (dwarf stocks both fibrous and stump-rooted as well as vigorous ones resulting from a well-balanced root system) Crab and Paradise stocks, and the range of growth and root system included in each class.

Selected types of Paradise, ranging from the dwarf to the very vigorous type, all raised vegetatively from layers, were planted out on their own roots to demonstrate their relative vigour. A selection was also made of crab-stock seedlings obtained from a foreign source through an English nurseryman in 1912. It was noted that when these seedlings, mostly 2 years old, were planted out, they appeared to be very even, and the majority exhibited a tap-rooting tendency. (The taproots were, of course, trimmed back at the time of planting).

At the first inspection a year after planting, the plants appeared to be very free growing and clean-stemmed at the base, and only a few were stunted and spiny. It is interesting to note that in the normal course of events at this point such a bed of stocks would have been " worked " before anything more was known about it, — hence the common impression among many tree-raisers that free and crab stocks vary little.

Certain typical plants were selected and were planted out in Feb. 1914 to grow on their own roots, which they were allowed to do until March, 1919, when they were lifted, in order to obtain a series of photographs of their relative growth and rooting characters. This series, included in this article, is a striking illustration and proof of the immense variation in vigour amongst so-called free or crab stocks.

A similar close examination was made of a collection of free stocks raised from the Pomace from an orchard in the west of England, and results were similar.

With regard to the desirability for working purposes and the possible means of overcoming this variability habit, the author awaits the results of the selected types upon different soils, before making any further statements concerning soil solubility, but confines his remarks to certain outstanding points.

A very complete series of Paradise would be made up by the selection of: —

Type I. — Broad-leaf for permanent bush trees and weak-growing sorts.

Type II. — Doucin or English Paradise — for bush fillers and general commercial dwarfing trees.

Type V. — Amélioré or Improved Doucin — for cordons and garden trees.

Type IX. — Jaune de Metz or Yellow Paradise, for extra precocity, probably useful on which to work new seedlings, pot trees, etc., to induce rapid maturity.

These are the most marked and constant indications on the soil under consideration with regard to definitely dwarfing types of stock.

There is apparently no distinct line betwixt free and Paradise stocks, each contains dwarfing and free-growing stocks, both capable of vegetative propagation. There are 3 possible lines along which a standardisation of free stock may proceed: 1) if seedling stocks are to be used, they should be graded at an early stage *i e.* at the time of planting out; 2) the stronger types of so-called Paradise should be selected, with free-rooting and growth habit, and deep anchorage, which appear identical with free stocks. Any of these types can be raised quickly by layers, wood and root cuttings, and could be used for standard purposes with comparative safety; 3) reproduction of the most promising sorts from root cuttings. When these better trees are lifted and their roots trimmed, these root cuttings should be preserved and kept separate from the inferior ones. Very good stocks can quickly be obtained by this method

II. Pears. — The object of the author is to place on record a summary of the commercially used dwarfing stocks for pears at the present time, different forms of quince being used almost exclusively for this purpose, though trees worked upon the white thorn (*Crataegus Oxyacantha*) and upon the Mountain Ash (*Pyrus aucuparia*) are occasionally to be found.

A collection of quince stocks from various nurseries was made, and it was evident that many and various varieties were in common use, but differing in vegetative characteristics, that several varieties had got mixed together, and that the variety of quince most recommended as a stock by the older writers namely the Portugal Quince — had practically gone out of use as a stock.

The author proceeded to a classification of the types, and gives a table showing the characters useful for identification in the growing season, and the average leaf measurements (on one-year bedded stocks) worked as follows:

	Breadth	Length	Leaf stalk
Tipe *A* (Angers)	4 6	5 64	0 66
» *B* (Common)	3 97	5.06	0.62
» *C* ?	4 16	4.77	0.64
» *D* (Paris or De Fontenay)	3 84	5.09	0.59
» *E* (Portugal)	5 47	6.82	1.09

Type A; undoubtedly the one in most common use to-day. It appears to be both a grower's and nurseryman's stock; it layers very readily, is vigorous and healthy in the nursery, and ultimately develops a very fine fibrous root system.

Type B; less vigorous and can be distinguished by the smaller acutely-tipped leaf; comes readily from wood cuttings; fruit small, hard and downy

Type C; very erect yet dwarf growth; small circular, yellowish crinkled leaves; soon lacks vigour and tips of shoots often die, roots well from wood cuttings.

Type D, exaggerated drooping habit and dark green elongated leaf; less fibrous and more coarse-rooted than other types; long weak lateral roots.

Type E; very large downy leaf, and stout vigorous growth; rarely roots in a single season; layering appeared to be more effective than the stool method employed for the others.

The average height measurement of bedded stocks (once transplanted) was as follows: A, 3 ft.; B, 2 ft. 4 in.; C, 1 ft. 11 in.; D, 1 ft. 10 in.; E, 3 ft. 5 in., and the spread for these 5 types respectively was 2 ft. 7 in. 1 ft. 10 in., 11 in., 2 ft. 9 in, 2 ft. 11 in.

Now that the period of classification is practically complete, the authors proposes to undertake a series of experiments with a fairly wide range of pears, as the whole question of pear growing commercially in Great Britain, and of double working varieties in general opens up a wide field for advance through careful research.

635 - **Restoration of Peach Trees Growing in Open Air.** — LAMPROY E., in the *Revue Horticole,* year 92, No. 2, pp. 32-34, 2 figs. Paris, Feb. 16, 1920

Cutting back with the object of restoring vigour is little practised with peach trees, because it is generally agreed that the old wood, in this case, does not produce branches or does so with difficulty. However, the operation may be suitable in *certain cases,* as was noted by NAUDIN and DECAISNE in the middle of the XIX century (*Manuel de l'amateur des jardins* Vol. IV, p. 423) and also by ALLEMAND, Director of the « Jardin des plantes » at Grenoble, who brought it to the notice of the Pomological Congress at Metz in the autumn of 1919 He described the very succesful experiment carried out over the whole of his peach orchard by COMPTE of Bernin near Grenoble Having been obliged to leave his property for three and a half years, COMPTE, on his return, found his peach trees growing in the open air destitute of small fruiting branches at the normal height, with their trunks excessively lengthened and their growth sickly. He cut back the branches well below all fresh growth. Vigorous branches sprung from the trunk and, in the following year, gave a finer crop than the trees of which he had simply pruned the ends of the branches.

The operation should be done with care; the branches should be cut with a sharp fine saw; each cut should then be smoothed with a pruning knife and covered with grafting mastic

From the discussion which took place at the Congress after ALLEMAND's communication, it would appear that the cutting back of peach trees in exposed conditions, gives variable results according to the environment. The author remarks that it would be useful to study the causes which influence the success of the operation.

636 - **The Oignies Peach, Belgium.** — DACHY, A., in the *Revue Horticole Belge*, Year II No. 4, p. 53, Huy, Apr. 1, 1921.

There are not many peach trees suited to northern climates; a good kind which is so suited is the Oignies peach which originated at Hainaut. Although not very robust in appearance the Oignies peach is very fertile, propagates itself by seed, can be grown either as bushes or in the open. The fruit is medium sized or very large according to the quantity; its skin is very downy, greenish yellow, and more or less red on the sunny side; the flesh is easily separated from the stone. It ripens at the end of September. This peach ripens perfectly on isolated trees if grown on a tree raised from seed, or on a grafted tree In other cases it is always much less sweet and notably so when the tree is grafted on a plum tree.

For successful growth of this peach, a warm, healthy, sandy soil which is fairly deep and a very sunny situation are required.

637 - **The Preservation of Tropical Fruits.** — WESTER P. J. (Agricultural Advisor, Bureau of Agriculture) in *The Philippine Agricultural Review*, Vol. XIII, No. 3, pp. 173-185, pl. 4 Manila, 1920.

Amongst the more than 200 species of fruits that grow in the Philippines, the following are recommended as suitable for the manufacture of preserves on a fairly large scale, and a description is given of each, combined with recipes suitable in each case:— Banana (*Musa sapientium* L.); Carambola (*Averrhoa Carambola* L.); chico (*Achras Sapota* L.); Condol (*Benincasa hispida* Cogn.); custardapple (*Anona reticulata* L.); ginger (*Zinziber officinale* Rosc); guanabano, (*Anona muricata* L.); guava (*Psidium Guajava* L.); jujube (*Ziziphus Jujuba* L.); kamia (*Averrhoa Bilimbi* L.); lanzón (*Lansium domesticum* Jack.); makopa (*Eugenia javanica*); mango (*Mangifera indica*); mangosteen (*Garcinia Mangostana* L.) nipa (*Nypa fruticans* Wurmb.); papaya (*Carica Papaya* L.); pineapple (*Ananas sativa* Schult.); santol (*Sandoricum Koetjape* Merr.) and tamarind (*Tamarindus indica* L.).

The mango is at present the only fruit produced in sufficient quantity to keep even a small factory running at full capacity during the mango season. The next largest supply is the santol.

638 - **The Breadfruit (Artocarpus communis L.) in the Philippines.** — WESTER, P. J. (Agricultural Advisor, Bureau of Agriculture) in *The Philippine Agricultural Review*, Vol. XIII, No. 3, pp. 223-229, pl. 4, Manila, 1920.

The cultivated, seedless form of breadfruit here discussed, rarely growing more than 15 m. high in the Philippines, originated in one of the Polynesian archipelagos, whence it has spread to a large part of the tropics elsewhere. While the tree does best with a rainfall of fairly equal distribution it is quite tolerant of short dry periods, and it also flourishes under irrigation.

The observation of the formation of adventitious buds on injured roots of the breadfruit tree led the author to conduct a series of experiments with root cuttings. The cuttings were inserted at Lamao from the latter part of May through June to July, i.e the close of a long dry season and the beginning of the rainy period. With proper treatment up to 80 % of the cuttings taken during this period showed promise of making healthy plants, but at any other time of year, very few cuttings will strike.

In nursery practice it has been found best to dig out the soil to a depth of 20 cm., and fill it with clean, medium coarse sand. The sand should be levelled, saturated with water and beaten hard The roots of the tree can then be dug up with care, and should not be allowed to become dry while they are exposed to the air, and should never be left exposed to the sun. The author considers it better to use many of the smaller roots for cuttings than to cut one or two large ones near the trunk of the tree. The small wounds are more quickly healed, and there is less danger of the tree being uprooted by typhoons. Cuttings should be 20 to 25 cm. in length, and it is advisable to paint the wound on the thickest end of the cutting with coal tar or white lead. The cuttings should then be inserted diagonally 12 cm. apart, in a trench with the thickest end from 3-6 cm. above the ground level.

After insertion of the cuttings, the sand should not be kept saturated by daily applications of water, and watering should be limited to once every 5 to 7 days. Occasional spraying is however beneficial or damp sacking spread over the cuttings during the hot part of the day and removed at night.

Some cuttings will be ready for removal 2 months after insertion, whilst others take 5 months. The majority will be large enough for transplanting to the nursery at the age of 7-8 months, and into the field, 6-7 months later. When transplanting, about $^3/_4$ of the leaves should be cut off. In the orchard, plants should be spaced from 10-14 m. apart.

The advantages attached to the cultivation of *Artocarpus communis* L. are evident: the trees are unaffected by locusts and other plant pests; even in the regions where the dry season is exceptionally long, if properly mulched, they would require very little water. The extended planting of breadfruit trees is therefore strongly recommended.

As regards the food value, it is interesting to note that the breadfruit comes next to the banana amongst the tropical fruits. The high food value may be noted from the following analysis adapted from the Report of the Hawaii Agricultural Experiment Station, 1914.

Fruit	Edible portion	Total solids	Edible portion						
			Ash	Sulphuric acid	Protein	Sugar	Fat	Fibre	Carbohydrates other than sugar
Bread fruit (Hawaiian)	77.75 %	41.82 %	0.952 %	0.049 %	1.575 %	9 49 %	0 190 %	1.204 %	27.89 %
Bread fruit (Samoan).	83 44	26.89	1.152	0.078	1.575	14.60	0.517	0.978	9.21
Banana (Chinese) . .	70 00	21.28	0 995	0.245	1.788	16.66	0 180	0.253	—
Mango (Curabao) .	73.00	17.02	0.450	0.140	0.220	13.-4	—	—	—

639 – **Re-afforestation in Mountainous Regions without Temporary Nurseries.** — DESCOMBES, P. and DEVAUX, H., in the *Journal d' Agriculture pratique*, New Series, Vol 35, 1921, Vol I, No 6, pp 118-119 Paris, Feb. 12, 1921

One of the difficulties of re-afforestation in mountainous regions is that the period of the year favourable for vegetation varies according to the altitude. Transplanting trees from a nursery at a lower altitude than the land to be re-afforested is generally impracticable in spring, because the trees commence growth in the nursery before the thaw in the land to be planted, and in autumn, because their growth has not stopped by the time the first falls of snow take place there. The French Forest Administration meets this difficulty by establishing temporary nurseries at the altitude of the land to be planted ; but their remoteness from inhabited places and the scarcity of labour makes the upkeep of such nurseries very difficult. The authors have therefore recommended a new method of re-afforesting mountains based on the use, in spring, of plants taken out of nurseries situated in the plains and kept in the cold up to the time when the thaw enables them to be planted.

This method has been tested by several experiments undertaken by the Central Society for forest management in mountains.

The Vignec territory (Hautes-Pyrénées), which covers an area of 30 ha. in the valley of the Aure, varying in altitude between 580 and 1120 metres, has been entirely re-afforested in this manner by a plantation of pines mixed with silver firs, made in 1908 and 1909, and in which broad-leaved trees have since been planted.

A plantation of acacias was made in 1908, by the same method, in the Testes du Plan territory, commune of Aragnouet (Hautes-Pyrénées) at an altitude of 1700 m.

This method has also been applied by the mountain dwellers of the Commune of Estensan (Hautes-Pyrénées), where the municipality has re-afforested two plots, one on a plateau and the other on the steep banks of a torrent.

All the plants used in these experiments were sent by passenger train, during March, to Vaux near Ferté-Imbault (Loir-et-Cher), taken quickly from the railway station to a place higher than the land selected for plantation, where they were stored in bundles separated from the ground by a wooden platform and covered with planks supporting a thick layer of snow, and, later, planted out as soon as the thaw had taken place on the area to be planted. Although the advantages of putting the plants in tubs during the interval between their arrival and planting out were known, it was thought preferable to avoid the injuries to which they would have been liable in unpacking and repacking for inevitable transport on mules over the paths connecting the depot with the area to be planted.

All these plantations have succeeded remarkably well. They withstood successfully the exceptional droughts of 1911 and 1918. Quick transport is an indispensable condition for success.

[639]

640 – **Tractors on Fire-Lines in the Landes, France.** — GREILSAMMER, R., in the *Journal d'Agriculture Pratique*, Year 84, No. 37, pp. 216-218, figs. 2. Paris, Sept. 9, 1920.

Description of trials organised by the Gironde Society of Agriculture on June 20 and 21 and on July 3 and 4, 1920, near Bordeaux in forests at Ychoux (Landes), with the object of solving, by means of tractors, the problem of clearance and upkeep of firelines by a mechanical process. Two firms took part in the tests, the " American Tractor Co. " (Colombes works, 33, Rue du Louvre, Paris, 2^e) entering a 36 H.P. GRAY tractor with one driving wheel. The RENAULT firm of Billancourt (Seine) entered a 20 H.P. RENAULT chain-track tractor. The upkeep of firelines in the Landes has become very difficult owing to the scarcity and high cost of labour. The work however, has considerable economic importance because fires destroy several thousand hectares of pine forest every year in that region and the damage caused ran to millions of francs.

In consequence of the abandoned state in which the firelines in the Landes have been left for several years they have become overgrown with very abundant vegetation composed of heaths of the genus *Erica* (forming what is known locally as " la brande "), gorse, broom, and even young pines. All this shrubby growth forms impenetrable thickets attaining a height of up to 2 or 3 metres in places. The destruction of this vegetation really constitutes a regular clearing and not merely a work of maintenance. The Renault tractor was attached to a kind of triangular extirpator made on the spot with a wooden frame very near the ground and working parts in the form of curved knives arranged to cut layers horizontally. When the tractor attached to this instrument had passed, the " brande " had been pulled up, but the work seemed very slow, and therefore not economical, on account of the constant clogging of the instrument which necessitated frequent clearances. This tractor is easily handled and requires small space for turning ; but rapid wear of the chain-tracks is to be feared in the very sandy soils of the Landes.

With the GRAY tractor the crushing of the woody growth by the weight of the machine was tried. This crushing was effected by the large driving wheel of the tractor armed with angle pieces which could even be sharpened for this work. The highest heaths and gorse were completely laid and even to a great extent broken ; this in itself is an interesting result as fires spread chiefly by the thickets at some height above the ground.

As the GRAY tractor travelled at 4 km. per hour and worked on an effective width of 1.60 metres, the work of crushing was very rapid, representing about 5 hectares a day.

The author thinks that by making several passages one after another using an extirpator with rigid teeth the vegetation would be completely eradicated. It would then be possible to collect the plants so uprooted into swaths by means of a special machine similar to the CASANOVA stone clearer formed with several strong rake teeth followed by a scoop for collecting the stones or uprooted stumps.

Only after clearing away the swaths formed by the debris of plants collected by the stone clearer could ploughing be done without excessive clogging.

After this ploughing the clearing of the fireline would be complete, and then only periodical work of upkeep with machines used in ordinary cultivation (pulveriser, cultivator, plough, etc.) would be required.

LIVESTOCK AND BREEDING

641 - **On Lathyrism or Poisoning Caused by Vetch Seed.** — MIRANDE, M., in the *Comptes rendus de l'Academie des Sciences*, Vol. 172, No. 18, pp 1142-1143 Paris, May 2, 1921.

After CANTANI, the term lathyrism has been given to the specific poisoning of man and animals caused by ingesting the seeds of certain vetches, especially those of *Lathyrus sativus* and *L. Cicera*.

Several cases of poisoning in horses fed with vetch having recently been reported from various places in France, the author investigated the seeds of *L. sativus* and *L. Cicera*, and obtained the following results:— The seeds crushed, ground or reduced to coarse flour and moistened with water, placed in a glass receptacle, at a temperature of 35° to 40° C., after some hours begin an auto-fermentation and evolve a fairly large amount of carbon dioxide and sulphuretted hydrogen.

The substance which decomposes and gives off sulphuretted hydrogen, is contained in the cotyledons and not in the tegument of the seed. The finer the grinding of the seed, the quicker this fermentation takes place; a medium fine flour gives off H_2S in 6 or 8 hours. If the ground seeds are macerated in water, the substance from which H_2S is generated is contained in the water; careful washing is however necessary to extract it totally.

The seed, decorticated or not, but left whole and placed in a small quantity of water does not give off sulphuretted hydrogen; if then dried, ground and moistened it does not give off sulphuretted hydrogen either. The simple commencement of germination in the unbroken seed has transformed the substance which generated H_2S.

The spontaneous fermentation which sets free H_2S hardly commences below 35° C.; it is very active between 35° and 40° C., the temperature of most warm blooded animals; it is produced also up to about 60° C., that is to say up to the average coagulation temperature of albuminoids. Above this coagulation temperature spontaneous fermentation does not take place, but, by boiling or in a digester (from 110° to 120° C.), direct but only partial decomposition of the substance generating H_2S is obtained. This partial decomposition is increased by the action of dilute acids.

The spontaneous sulphuretted-hydrogen fermentation is caused by the slow action of water; it does not appear to be influenced by any phenomenon of oxidation or of reduction.

The author succeeded in extracting from these seeds a substance which by heat alone, or still better with dilute acids, gives off sulphuretted hydrogen.

CORNEVIN (*Des plantes vénéneuses et des empoisonnements qu'elles* *déterminent*, Paris, 1887. Lib. Firmin-Didot) and other writers have observed that if the vetches are given to horses after soaking, the soak water being rejected, they are harmless. CORNEVIN states also that, if the vetch-seeds crushed or reduced to flour, are fed to animals the symptoms of illness appear more rapidly than if they are given whole and without having been crushed or ground. The author's experiments explain these facts. The poisoning seems to be really caused by the sulphuretted hydrogen which is set free in the stomach of the animal as *in vitro*. The great toxicity of sulphuretted hydrogen gas, which attacks the blood corpuscles, takes oxygen from them and causes the formation of iron sulphide in them, is known. Animals die from asphyxia, sometimes very quickly, sometimes after a more or less long period. In the latter case they perhaps die from slow injuries of the blood corpuscles.

642 - The Value of Arsenical Dips as Remedies against Scab in Domestic Animals in the Colonies.

— VELU, H. (vétérinaire de première classe), in *La Colonisation Française au Maroc*, Year II, No 15, pp. 4-5. Casablanca, Jan. 8, 1921.

The author states that no simple and practical treatment of scab capable of application on a large scale in the Colonies, requiring neither expensive plant such as sulphur fumigating chambers or dipping tanks (1), nor considerable manual labour under careful supervision, by a staff without any technical knowledge as has yet been devised.

The foreign literature, however, is very rich in publications on sulphur and arsenical dips and numerous formulæ have been recommended. In 1915, in South Africa, BEDFORD (2) tested 18 dips prepared extemporaneously (formulæ or specialities) against scab in sheep: all except one proved efficacious and cured the scab by two minute immersions repeated at intervals of 9 days.

The author tested one of these specifics, probably an arsenical cresyl, "Cooper's Fluid," well known to breeders in South Africa, Australia, and even in Madagascar. The results obtained with this product in the treatment of scab in pigs were perfect: four dippings of about 2 minutes, repeated at intervals of 7 days, sufficed to cure the diseased animals; "Cooper's Fluid" also proved a quick and easy remedy against sarcoptic scab of horses imported into Morocco after the war.

The method was as follows: — When the 150 sick horses arrived at the hospital a small tank was made in 24 hours by building a cement wall 20 cm. in height; 200 litres of antiseptic solution were got ready of a strength of 15 %. The horses were led into the tank and douched by means of a spraying pump furnished with a long tube and a VERMOREL jet-nozzle; a spraying nozzle was too easily obstructed and the liquid did not penetrate sufficiently. Each day the liquid which had been used was put back, filtered through gauze. To prevent the dip getting too weak and to replace loss, 100 litres of freshly prepared solution were added each morning. In this way 25 horses were treated a day (a number which might easily have been doubled), the douche was repeated once a week and the total number of douches was 3 or 4. Although this process only permits of a restricted number of animals being treated daily it is, however, very simple, the cost is very small and it can be employed anywhere, being sufficient for the treatment of sick horses in a military post of several hundreds of horses or in breeding farms, where the stock never exceeds 1000 head.

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(1) See *R.* Jan. 1919, No. 78; *R.* July-Sept. 1919, No. 922; *R.* Jan. 1920, No. 68; *R.* Nov.-Dec. 1920, No. 1135. (*Ed.*)

(2) BEDFORD G. A. H., in *Union of South Africa Dep. of Agr. 3rd and 4th Reports of the Director of Veterinary Research*, 1915, pp. 163-172. (*A.*)

The author also explains that this process has the great merit of avoiding the usual disadvantages of dips for destroying parasites, such as variations in the concentration of the dip, errors in strength and above all the decomposition of sodium arsenite. Most of the dips used in South Africa, including Cooper's Fluid, contain sodium arsenite and not arsenious acid or arseniate of soda as do the French dips and it is, perhaps, to this fact that they owe their destructive power on parasites and their being less poisonous: the efficiency of these dips is further increased by the addition of an emulsion to wet the tissues.

The author further explains the composition and preparation of two other dips used in English-speaking countries and which have been employed up to date only as remedies againsts ectoparasites in cattle, namely CHAPLIN's sulphur solution recommended by the Bureau of Animal Industry Washington, and WATKINS-PITCHFORD's arsenical solution, which ought to be tried in the treatment of scab in horses. These solutions are composed and prepared as follows:—

I. — CHAPLIN'S SULPHUR SOLUTION. — Take 8 lb. of quick lime or 10 ½ lb. of slaked lime, 18 lb. of sublimed or powdered sulphur, 10 gallons of water. Stir and keep boiling for one hour. Then add water to bring the volume up to 10 gallons. Dilute when required for use in the proportion of 1 volume of concentrated solution to 9 or 10 volumes of water for sheep and to 7 or 8 volumes of water for horned cattle.

II. WATKINS-PITCHFORD'S ARSENICAL SOLUTION:—

Sodium arsenite (80 % arsenic)	4 lb.
Soft soap	3 »
Vaseline oil	1 gallon
Water	100 gallons

Dissolve 4 lb. of sodium arsenite in about 1 gallon of hot water; when the solution is cold, add cold water to make the volume up to 88 gallons; then add the emulsion stirring constantly and make up with water to a volume of 100 gallons.

According to the author these dips, including Cooper's Fluid, have some drawbacks. The sodium arsenite may cause more of less serious inflammation of the skin, which becomes covered with cracks, and diarrhoea, or it may become inactive by changing into arseniate. However, these occurrences will always be of slight importance, and should not prevent the adoption of this method of treatment of scab in domestic animals.

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643 - Experiments on the Value of Intratracheal Injection for Creating Active and Passive Immunity. — PFENNINGER, W., in the *Annales de l'Institut Pasteur*, Year 35, Vol. XXXV, No. 4, pp. 237-260, tables 14, figs. 5. Paris, Apr. 1921.

With the object of finding a solution of the questions which resulted from the researches of BESREDKA (1) who was the first to record that, compared with intraperitoneal and intravenous channels, the respiratory channel is equally accessible if not more so, to injections of serum, the author investigated the production of anti-bodies (agglutinins, precipitins, bacteriolysins and bactericidins) by making intratracheal injections of antigens; the production of active and passive immunity; and the therapeutic value of serums injected into the trachea.

Notably in the researches on immunity, the animals inoculated by peritoneal (control animals) and intratracheal injections were tested with one or more lethal doses.

One series of experiments was made with rabbits and guinea pigs immunised against paratyphus virus B., another series of experiments was made with guinea pigs which had previously been used for the production of anticholera serum. In order to verify the transmission of passive immunity, experiments were made on guinea pigs by giving them injections of anticholera serum. The results of these experiments, the details of which are recorded in numerous tables and graphic figures, are as follows: —

1) By means of intratracheal injection of paratyphus virus B it was possible to give rabbits active immunity enabling them to resist three times the lethal dose.

Comparative researches regarding the immunity obtained by respiratory and peritoneal channels in guinea pigs, showed that intratracheal injection produced greater immunity against paratyphus virus B than intraperitoneal injection, and further that intratracheal injections are better endured. Comparative researches on guinea pigs immunised against cholera vibrio gave similar results.

2) The protective power of anticholera serum proved greater in intratracheal than in peritoneal injection.

PRACTICAL CONCLUSIONS. — According to the author the results of these experiments on active immunity, combined with those which BESREDKA obtained in experimental tuberculosis of the rabbit appear to justify the hope that the method of intratracheal injection possibly offers a prospect of obtaining active immunity in bovine tuberculosis. At any rate, in the case of many contagious diseases, the injection of serum might be attempted through the respiratory channel.

644 - Bovine Foot and Mouth Disease (2) is not Transmissible to Man; Human Aphthic Stomatitis is not Transmissible to Cattle. — LEBAILLY, C., in the *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 18, pp. 1140-1141. Paris, May 2, 1921.

Classic treatises on human medicine and on veterinary medicine, teach, on the strength of experiments made in Germany in 1834, that foot and mouth disease (aphthic fever) is transmissible from animals to man through milk. Periodically, observations are published which seem to confirm this. But the author having carried out an inquiry which he details in this note, thinks it justifiable to conclude from his observations and experiments that bovine foot and mouth disease and human aphthic stomatitis are absolutely distinct diseases, since the former cannot be transmitted experimentally to man nor the latter to cattle.

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(1) *Annales de l'Institut Pasteur*, Vol. XXXIV, pp. 51 and 361. Paris, 1920. (*Ed.*)

(2) See *R.* March 1920, No. 335; Sept. 1920, No. 882; March 1921, No. 309. (*Ed.*)

645 – ***Cysticercus cameli*, a New Hydatid Found in the Heart and Diaphragm of the Egyptian Camel.** — Abdel Aziz Eff Nomani, in *The Agricultural Journal of Egypt*, Vol X, p 69, 1 fig Cairo, 1920

During the course of a meat inspection at the Cairo abattoir, the author met with a heart of an Egyptian camel invaded with a bladder-worm having the general appearance of *Cysticercus bovis* which, as is known, is occasionally found in camels. No parasites were found in the skeletal muscles, but the diaphragm, as well as the heart, contained them in small numbers.

Careful examination of the camel hyatid showed that it was neither *Cysticercus bovis*, nor *Cysticercus cellulosae*. The cysticercus itself is oval, or elliptical in shape, and varies in size from 8 to 10 mm in length, and from 3 to 4 mm. in breadth. Each cysticercus possesses a white spherical head (*scolex*) about 2 mm. in diameter. The head is armed with a double row of hooks varying in number from 43 to 45, and possesses 4 oval suckers, one at each corner of the head. The neck contains calcareous granules.

The hooks are somewhat longer and thicker than those of *Cysticercus cellulosae*. Those of the outer row are smaller than the hooks forming the inner row, which are longer and more slender.

The author proposes giving the parasite the name of *Cysticercus cameli*.

646 – **Poisoning of Geese by the Nut of the Cabbage Palm (*Areca oleracea*) Given as a Remedy against Tape-worms, in Germany.** — Heidrich, in the *Berliner Tierärztliche Wochenschrift*, Year XXIII, No 9, p 102 Berlin, March, 1921; extract from *Bericht uber das Veterinarwesen in Sachsen fur das Jahr*, 1918, p 100. Dresden, 1921

A large number of geese affected with *Taenia lanceolata* and *Taenia fasciata* were treated, through the mouth, with powdered cabbage-palm nut. The medicine was given in mouthfuls with bread and butter. Geese that were obviously ill were only given half the prescribed dose. A few minutes after administration the geese vomited the mouthfuls, struggling and salivating. One strong goose fell down with its neck and legs rigid and had to be killed. According to Zurn cabbage-palm nut is the best remedy for tape-worms for poultry. The dose recommended, 3 gm., appears to be decidedly too great.

647 – **The Crevat Method of Rational Feeding for Cattle.** — Censi Mancia, G B, in *La Riforma agraria*, Vol II, No 2, pp 84-88 Parma, Feb, 1921.

According to the author, Crevat's book on the rational feeding of cattle, a work which gained a prize from the Société des Agriculteurs de France in 1885, has not yet been thoroughly discussed.

Crevat wished to dispute the classic method, according to which the ration is proportional to the live weight of the animal, and he based his work on the "law of rations of proportional intensity." This law is supported by the fact that small animals have, relatively to their weight, a greater muco-cutaneous area than that of large animals; it is therefore logical to suppose that they ought to have, proportionally, greater food requirements.

With the help of numerous references to the literature, the author criticises the hypotheses of CREVAT according to which: — 1) The muco-cutaneous area is proportional to the square of the thoracic perimeter; 2) the live weight of various animals is proportional to the cube of the thoracic perimeter; 3) the rations (R) are proportional to the cube roots of the squares of the weights (P). But, while the last rule speaks of proportionality, CREVAT expresses it by an equality: $R = \sqrt[3]{P^2}$. The author points out the necessity of introducing an average coefficient of proportionality (K) which varies according to the species and breeds and he calculated this coefficient from the average daily amount of good natural meadow hay consumed by 6 sheep and 3 head of cattle fed *ad lib.* for 10 consecutive days. For the sheep, he obtained K = 0 56, for the cattle K = 0.89 and, respectively: —

$$R = 0.56 \sqrt[3]{P^2}; \qquad R = 0.89 \sqrt[3]{P^2}$$

The data used in the estimation of these coefficients are shown in the appended Table, which shows that the two species considered are by no means constructed on similar models. In cattle the thoracic perimeter is about two and a half times greater than in sheep, whilst the cutaneous area is about 6 times greater and the food requirements are 10 times greater,

According to the data given in the Table, the author calculates that, per unit of skin area, large animals need a larger food ration than small animals. Thus, for sheep the quantity (in kg.) of grass required is about $^1/_{13}$ of the thoracic perimeter expressed in cm.; for cattle it is about $^1/_3$; the corresponding requirements of hay are about $^1/_{54}$ and $^1/_{13}$. Now, if the percentage ratios between the live weights of the animals are worked out the same results are arrived at. The ratio between the live weight and the cutaneous area $\frac{P}{S}$ shows that, in the cattle used in the experiment, the cutaneous area in square dcm corresponds approximately to the live weight in kg. while in the sheep it is about 4 times greater.

A coefficient of proportionality should therefore be introduced into the formula used for calculating the nutritive activity A, which CREVAT considers proportional to the ratio between the ration R and the live weight of the animal P $\left(A = \frac{R}{P}\right)$.

The formula of equality $A = \frac{\sqrt[3]{P^2}}{P} = \sqrt[3]{P^2 : P^3}$ assuming that

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$R = K\sqrt[3]{P^2}$, ought to be corrected as follows:

$$A = \frac{K\sqrt[3]{P^2}}{P} = K\sqrt{\frac{P^2}{P^3}} = \sqrt{}\ P$$

that is to say, that the activity would be inversely proportional to the cuberoot of the weight.

In the case of the animals used in the author's experiments, the food requirement per 100 kg live weight was 17 2 kg. of grass, corresponding to 4.3 kg. of hay, for the sheep ; 10 9 kg. of grass, corresponding to 2.7 kg of hay for the cattle; whereas **Crevat** obtained the following figures. for sheep 30.7 kg of grass = 7.65 kg. of hay; for cattle 12.2 kg. of grass = 3 5 kg. of hay. The theory of the ration proportional to live weight, fixing the necessary quantity of hay at 3 33 kg per 100 kg. live weight, gives the large animals too much and the small animals too little , **Crevat**, by confusing proportionality with equality erred, according to the author, in the opposite direction.

The practical formula of **Crevat**, $R = C^2 \times 5$, signifying that the ration is equal to the square of the thoracic perimeter in cm. multiplied by 5, would give sheep a ration more than double that consumed in the experiments and to cattle an excess of 4 kg of grass per day.

Finally the author criticises **Crevat**'s law on the early maturity of breeds of animals and the deductions that have been made from it, and concludes that " there is no reason to contest the old classic method which makes the rations proportional to live weight, but it is very necessary to ascertain the precise food requirements for each species of animals "

Number	Animal	Live weight	Thoracic perimeter	Average daily ration of grass	Average daily ration of hay	Average coefficient K for calculating the ration	Cutaneous area	Coefficient K for the calculation of the area	Ratio between the area and the grass ration	Ratio between the thoracic perimeter and the ration	Ratio between the live weight and the area	Nutritive activity $\frac{R}{P}$ Requirement for 100 kg of live weight	
		kg	cm	R=kg	$\frac{R}{4}$ = kg		dm²		$\frac{S}{R}$	$\frac{Pt}{R}$	$\frac{P}{S}$	Grass	Hay
1	Sheep of Garfagnino breed	38 0	90	6	1 5	0.56	94 8	8 387	$\frac{1}{16}$	$\frac{1}{13}$	0 36	17 2	4 3
2	» »	38 2	81				114 8	10 120					
3	» »	32 5	80				90.8	8.916					
4	» »	32.1	80				90 4	8.950					
5	» »	32 7	83				92 1	9 006					
6	» »	33 9	78				92 6	8 840					
7	Young Muccopisano, bullock .	489,0	190	60	15	0 89	499 2	8 043	$\frac{1}{9}$	$\frac{1}{3}$	0 99	10 9	2 7
8	Muccapisano Cow	570,0	201				560 0	8 146					
9	Chianino bullock . . .	600,0	206				608 0	8 547					

648 - **Study on Inbreeding, Especially as Regards its Supposed Relation to Mendelian Laws.** — HENSELER, H., in the *Zeitschrift fur Gestutkunde und Pferdezucht*, Year XV, Part 7, pp. 137-143. Hanover, July, 1920.

The author, in his study on consanguinity as a method of breeding, broaches the question of the supposed relation of inbreeding and the Mendelian laws, objecting that this idea has been rather hastily introduced into German text books and manuals of zootechnology.

He deals notably with the results of FRÖHLICH'S researches in PUSCH HANSEN, *Allgemeine Tierzucht*, new edition, p. 275, which attempt to prove how the probability of the appearance of homozygous and heterozygous descendants should develop among 64 animals of different degrees of consanguinity which consequently ought to lead to the combining of methods of experimental research in heredity with the methods of genealogical research based on Mendelian laws. The results of these researches are indicated in Table I.

TABLE I. — *Results of* FRÖHLICH'S *researches.*

Degrees of consanguinity Remove (1)	Dominant Homozygotes (out of 64 animals)	Heterozygote (out of 64 animals)	Recessive Homozygotes (out of 64 animals)
I-II	48	16	0
II-II.	36	24	4
II-III	30	28	6
III-III	25	30	9
III-IV	22.5	31	10.5
IV-IV	20	32	12
IV-V	19	32	13
V-V	18	32	14
II-II	17	32	15
II, III-III	36	24	4
II, IV-IV	33	26	5
III, III-III	30	28	6
III, III-IV	27.5	29	7.5
III, IV-IV	25	30	9

(1) Remove = Ligne ancestrale (Vendi) = Ahnenreihe (German) (*Ed.*)

Assuming that a founder is homozygous at least in respect of one character, the author obtains the same figures by the following calculation :—

TABLE II. — *Consanguinity with removes II-II.*

● AA	A a	● AA	A a
The sexual cells contain :-			
100 % A	50 % A 50 % a	100 % A	50 % A 50 % a

According to the calculated estimate, the progeny would have the following hereditary tendency as regards the character AA:—

Homozygote AA 50 % and	Homozygote AA 50 % and
Heterozygote Aa 50 %	Heterozygote Aa 50 %

The sexual cells consequently contain:—

75 % A and 25 % a, that is to say in 75 % A and 25 % a = 3 A: 1 a in the proportion 3 A : 1 a

The composition of the hereditary mass of the descendants can be calculated as follows:—

3 A : 3 A = 9 AA
3 A : 1 a = 3 A a
1 a : 3 A = 3 a A
1 a : 1 a = 1 a a

or 9 AA : 6 A a : 1 a a. Consequently, for 64 decendants: 36 AA. 24 A a: 4 a a

TABLE III. — *Consanguinity with removes IV-IV.*

● AA	A a	A a	A a	A a	A a	A a	A a	● AA	A a	A a	A a	A a	A a
100 % A	50 % A 50 % a	50 % A 50 % a	50 % A 50 % a	50 % A 50 % a	50 % A 50 % a	50 % A 50 % a	50 % A 50 % a						

50 % A A
50 % A a

25 % AA
50 % A a
25 % a a

3 A: 1 a   1 A: 1 a   1 A: 1 a   1 A: 1 a

3 AA: 4 A a: 1 a a
62 $^1/_2$ % A and 37 $^1/_2$ % a
5 A: 3 a

1 A: 1 a

The right half of the genealogical table corresponds to the left half

5 A A: 8 A a: 3 a a
56 $^1/_4$ % A and 43 $^3/_4$ % a
9 A: 7 a

81 AA : 126 Aa : 49 aa = total 256.

Consequently, for 64 descendants (divide by 4):—

20.25 AA : 31 5 Aa : 12.25 aa

Making the same calculation for the degrees of consanguinity with removes II-II and V-V, the following composition of the hereditary formula of the descendants is obtained:—

Removes II-II 25 AA : 30 Aa : 9 aa.
» V-V 18.0625 AA : 31.875 Aa : 14 0625 aa.

The following series results:—

1st	generation	the ratio in	the	sexual	cells is	3 A : 1 a
2nd	»	»	»	»	»	5 A : 3 a
3rd	»	»	»	»	»	9 A : 7 a
4th	»	»	»	»	»	17 A : 15 a
nth	generation	»	»	»	»	$2n-1 : 2n'-1$

Now, the author observes that this same calculation and the same reasoning hold good when the AA animals are not the same, that is to say, when no consanguinity or relationship exists. On the other hand, it would be possible, inversely, to proceed to in-breeding when the founder, with regard to its hereditary characters, is not homozygous but heterozygous and consequently to prove the reverse by this method of calculation. The author further remarks that by examining the degree of consanguinity with removes IV-IV, a degree of consanguinity by which practically the best results are obtained, it can be shown that as many homozygous descendants as heterozygous are probable, and that further, with relatively close degrees of consanguinity, with removes II-III and III-IV, even more heterozygous than homozygous descendants are probable.

According to the author, these facts show that there is no direct relation between consanguinity and the Mendelian laws. In his opinion the very fact of the reduction of ancestors or, which comes to the same thing, the accumulation of ancestors, proves sufficiently that the value of consanguinity has a biological basis and that the Mendelian laws and consanguinity are not inconsistent with each other.

649 - **Horse-Breeding in Brazil.** — I. SILVA, H., As raças equinas no Brasil, in the *Rivista de Commercio e Industria*, Vol. VII, No. 73-74, p. 16. Rio de Janeiro, Feb 1921. — II. RIET, M., O cavallo nacional. *Ibid.*, p. 15.

I. — After a stationary and almost regressive period, horse breeding in Brazil has made a great advance during the last few years. In the States of Rio Grande do Sul, São Paulo, Paranà, and Minas Geraes, a large number of horses of selected breeds (Arabs, English thoroughbreds, Anglo-Norman, etc.) have been imported and bred.

The predominant breed in Brazil is an Arab or one of its varieties, degenerated.

Assis BRASIL has imported for his stables in the commune of S. Gabriel (Rio Grande do Sul) valuable thoroughbred English and Arab stallions which have produced very fine results with native mares. English and Arab half-breds are now numerous in the plains of the Rio Grande and especially in the communes of Uruguayana, Rosario, Tangussú, Cacimbinhas, Caçapava, and D. Pedrito.

At São Paulo, a Government Stud Station attached to the " Posto zootechnico " is in full activity. In that State, the production of 3 types of horse :— 1) Military ; 2) agricultural ; 3) of high commercial value ; is aimed at. Another Station provided with stallions purchased in Europe is found at the " Posto zootechnico " of Moóka.

In some localities in the State of S. Paulo there are some fine riding and driving mares, Anglo-Norman thoroughbred and half-bred, Orloff thorough bred and halfbred, and fine specimens of the native breed. In the State of Minas Geraes, which also has some fine riding and driving horses, the " Real Candelaria de Campo " was founded in 1819, with the object of improving horse breeding. Arab stallions being used. When the Imperial form of government fell, the establishment remained the private property of the ex-emperor, and it now belongs to the Salesian Fathers.

Among the most celebrated breeds of horses in the State of Minas Geraes may be mentioned the " sublimes," " monarchas," " manga largas," and " pampas."

In Paranà, good horses are also found, particularly in the communes of Ponta Grossa, Castro,and Guarapuava. A pre-eminently national type of horse is the " curraleiro," which is also called " cavallo sertanejo " in the State of Goyaz. The best horses of this breed are bred in the Vão do Paranan, a zone on the borders of the States of Minas and Bahia ; but this breed extends all over the north of the State of Goyaz. " Curraleiros " are not remarkable for speed, but they excel in standing hard work and by their hardiness. This breed is of medium height at most, but its muscles are firm and stand any test ; it is well shaped, very agile and its coat is fine and glossy ; by selection a valuable breed might be created. " Curraleiros " stallions put to half-bred Argentine mares have given fine produce of a greater height, which is very important as the regular type of horse for the Brazilian army must be 1.48 m. in height.

II. — The author regrets that the English thorough bred has been chosen for the improvement of Brazilian horses and that the method of crossing with European breeds, which are produced in a very different environment from that of Brazil, has been generally adopted He insists that, on the contrary, recourse should be had to selection of the native horse, which is valuable on account of its reliability, resistance, and hardiness.

650 – **The Creation of an American Utility Horse.** — WILLIAMS, J O , in *U. S. Department of Agriculture, Department Circular*, 153, 22 pp , figs 17. Washington, March, 1921.

American light horses have long been world-famous in several highly specialised lines — for example, the trotting and saddle breeds.

The United States Department of Agriculture has recognised the need of developing a type of the native light horse suitable for general utility work on farm or ranch. Such a type would also supply desirable horses for the army. With this end in view, co-operative experimental breeding work has been carried on for many years by the Department of Agriculture and horse-breeders. The ideals sought in this new type of horse are a uniform combination of size, substance, soundness, endurance and a sufficiency of speed.

Although the motor-car, motor-truck, and tractor undoubtedly will displace some horses, nevertheless, the active, sizable, utility horse will be an increasingly important factor in American farming, especially in those sections where the heavy-draught breeds are not the most economical type to use.

The co-operative breeding work was begun in 1904, with several selected mares, and the standard-bred stallion "Carmon." This remarkable sire is still used in the development of the work. The Bulletin analysed describes the progress hitherto made at the United States Wyoming Horse-Breeding Station.

651 - **Cattle-Feeding Experiments at the Kansas State Agricultural College, U. S. in 1918-1919.**—McCampbell, C. W., Bell, F. W., and Winchester, H. B., in *Agricultural Experiment Station, Kansas State Agricultural College, Department of Animal Husbandry, Circular No.* 77, 11 pp., fig. 1 Manhattan, 1919.

In the first part of the Circular analysed, Messrs. Campbell and Winchester describe a feeding experiment, lasting 120 days, that was made with 39 two-year-old steers divided into 4 lots, with the object of ascertaining how far the maize grain ration could be reduced, in order to lessen the maintenance costs by the maximum use of lucerne hay and sorghum silage.

The course of the experiment and the chief results obtained are summarised in the following Table.

Substituting sorghum silage for maize grain in the ration of two-year-old steers.

Ration	Average initial weight	Feeds consumed per 100 lbs of increased weight: Ground maize	Linseed meal	Lucerne Hay	Sorghum Silage	Percentage of Shrinkage in marketing	Dressing percentage	Ranking of carcasses in cooler
	lb.	lb.	lb.	lb.	lb.	%	%	
I Ground maize 15.45 lb + linseed meal 2.74 lb lucerne-hay 13.14 lbs.	944.92	477.54	84.72	406.91	—	3.18	59.74	2
II Ground maize 15.11 lb + linseed meal 2.68 lb lucerne hay 2 94 lb + sorghum silage 25.26 lb.	949.60	492.34	87.36	95.68	822.74	3.11	61.05	1
III Ground maize 7.69 lb linseed meal 2.72 lb lucerne hay 2.97 lb. orghum silage 41.84 lb.	960.20	292.08	103.33	112.67	1589.00	3.54	60.37	3
IV Linseed meal 2.70 lb + lucerne hay 2.95 lb + sorghum silage 60.26 lb.	963.10	—	87.42	95.31	1949.51	5.40	56.80	4

Reckoning the food at the current prices at the time the experiment was made, all the lots were sold at a loss, but the latter was less in the case of lot IV (without maize) although these animals gave lower dressing results and lost much weight on the journey.

In the second part, Bell gives the results of comparative experiments between maize silage and sorghum silage in fattening baby beeves. The experiments lasted 90 days. Fifteen young steers and 15 heifers (weighing on an average about 459 lb.), were divided into 2 lots each of which were fed the same amount of ground maize, linseed meal and silage. The daily increase in live-weight per head of the lot given maize silage was 2.54 lbs; that of the lot fed sorghum silage attained 2 62 lbs. The latter animals made slightly larger and cheaper gains, dressed at a higher percentage and showed carcasses of better quality than the calves of lot 1. The year being a bad one for maize the sorghum made a yield of 9 tons of silage per acre as compared with 3.5 tons for the maize.

In the third part, a comparison is made between one lot of two-year-olds reported in Part I of the Circular (lot IV) fed on sorghum silage, and one lot of baby beeves reported in Part II. All the animals received as much maize, lucerne hay and sorghum silage as they could eat, and approximately 2.5 lbs of linseed meal daily per 1000 lb. live-weight.

The two lots were fattened to the end upon the same food that they were given at first. It required 150 days to make the calves as fat as the two-year-olds at the end of 120 days. In order to make 100 lb. gain, the baby-beeves consumed 367 76 lb. ground maize, 64.14 lb linseed meal, 117.51 lb. lucerne hay and 679.77 lb. sorghum silage, whereas the two-year-olds needed respectively 492.34 lb. (33 % more); 87.38 (36 % more); 95.68 lb. and 822.74 lb. (21 %) which shows that it pays better to feed baby-beeves than two-year-olds, if the animals are destined for beef-production.

652 - **Experiments in Feeding Beef Cattle in Nebraska, United States.** — Gramlich, H. J., in *Agricultural Experiment Station, the University of Nebraska, Lincoln, Bulletin* 174, 22 pp, figs. 6. Lincoln, September 1919

The feeding experiments began on November 22, 1917, and were carried on for 130 days with 5 lots of 10 cattle each. Three lots were used, in order to compare the results obtained with coarsely ground, or snapped maize, and whole maize. The supplementary protein food given consisted of cotton seed cake (broken into pieces of the size of a hazel nut): the only bulky feed was lucerne hay. Lot 4 received no supplementary food; lot 5 was given maize silage, instead of maize corn. The cattle were followed by pigs, and as the grain ration was increased, more pigs were added.

The Table on p. 747 gives the most important results.

The feeds are charged as follows:

	$	
Shelled corn	1.40	per bushel
Snapped corn	1.50	» cwt
Cottonseed nut cake	60.00	» ton
Lucerne hay	25.00	» »
Silage	10.00	» »
Grinding maize	04	» bushel
Grinding lucerne hay	3.00	» ton

The control lot (No. II) did not succeed at the beginning of the experiment.

The results obtained lead to the following conclusions:

1) The addition of 1.71 pounds of cottonseed nut cake to a maize and lucerne ration failed to increase the rate of daily gain, but increased the feed required per pound gain by 0.56 pound, and the cost of 100 pounds of gain by $2.16. It also decreased the profit $2.65 per steer (Lots I and II).

2) The grinding of maize and lucerne, when these are fed in conjunction with cottonseed cake, gave a 0.32 pounds per day larger gain at a materially reduced cost per 100 pounds gain, namely $2.08 and increased the profit per head from $5.56 to $11. It also reduced the pork produced per steer from 42.6 to 28.9 pounds (Lots II and III).

3) The feeding of snapped maize + cotton-seed nut cake + lucerne hay in comparison to shelled maize + cottonseed nut cake and lucerne hay gave a slightly greater daily gain, and a $5 cheaper cost per 100 pounds of gain. The feeding of snapped maize gave, exclusive of pork, a profit of $13.87, in comparison with $1.26 loss where shelled maize was fed; and inclusive of pork, a profit of $19.85 in comparison with $5.56 (lots II, and IV).

4) The feeding of a heavy silage ration did not produce as much fattening as the feeding of maize in conjunction with cottonseed nut cake and lucerne, but the animals put on a considerable amount of flesh, and the market price left a margin of profit. This amounted to $1.49 per steer, in spite of the fact that the sale price was $1 per 100 pounds less than when the steers received a heavy feed of maize (Lots II and V).

Comparison between the different ways of preparing maize for fattening cattle.

Lots	Maize modes of preparation	Average initial weight	Average daily gain	Feed required per lb. gain			Cost per 100 lb.-gain	Value per cwt.	Dressing percentage	Pounds pork per steer
				Maize grain or silage	Cotton seed nut cake	Lucerne hay				
		lb	lb.				$	$	$	$
I	Whole maize	835.5	2.77	6.54	—	4.24	21.65	14.50	60.69	38.9
II	Whole maize	837.7	2.56	6.47	0.67	4.50	23.81	14.50	57.29	42.6
III	Coarsely-ground maize . .	831.5	2.87	6.15	0.54	3.12 (2)	21.73	14.85	59.85	28.9
IV	Snapped maize (108 days) . .	825.0	2.64	1.34(1)	0.79	3.08	18.81	14.50	59.27	37.4
V	Maize silage . .	830.0	2.20	23.66	1.73	0.99	18.26	13.50	58.48	45.8

(1) Shelled maize substituted for snapped maize for the last 22 days since snapped maize was no longer available. — (2) Ground and fed, mixed with grain.

653 - **Experiments in Fattening Steers in Oregon, United States.**— POTTER E. L., and WITHYCOMBE, R., in *Station Bulletin* 174, *Oregon Agricultural College Experiment Station, Eastern Oregon Branch Station*, pp. 16, figs. 2 Corvallis, Oregon, August 1920.

A report of a series of experiments begun in 1913-1914 in the winter-fattening of cattle in the open. At the commencement of the tests, the weight of the animals was from 967.72 to 1066.13 pounds.

The first year's work was a comparison of three different kinds of hay, no other food being given. It was found that lucerne hay increased the live-weight twice as much as wild hay, and three times as much as awnless barley hay. The object of the further experiments was therefore to determine the best way of feeding lucerne hay.

When the steers (cross-bred Herefords 2 years of age) were given all the lucerne hay they could eat, and 5 lb. daily of rolled barley for the whole duration of the experiment (120 days), or 10 lbs of rolled barley for the last 60 days, the average daily gain in live-weight was 1.24 lb. and 1 17 respectively, while it was only 0.92 lb. when they were receiving hay alone.

When silage was added to the lucerne hay, the average gain in live-weight was 1.93 lb. as against 0.94 lb. when lucerne hay alone was fed. Chopping increased the nutritive value of lucerne hay 28 % when fed alone ; 14 % when barley was added, and 7 % when silage was also given. In most cases, however, the improvement was not equal to the cost of chopping.

The most satisfactory and economical of all the rations tried was hay and silage, therefore the authors advise its use in fattening cattle during the winter months.

The different animals which, at the end of the experiments, were in a half-fat condition were turned out to pasture in the following spring. Their average daily gain in live-weight was 1.00 lb. the first month; 2.39 lb. the second ; 2.31 lb. the third, and 0.70 lb. the fourth. The steers finished on pasture fetched the highest prices.

654 - **Relative Values of Feed Proteins for Dairy Cows.** — LARSEN, C., WRIGHT, T., JONES, H., HOOVER, H., and JOHNSON, B., in *Bulletin 188 of the Agricultural Experiment Station, South Dakota State College of Agriculture and the Mechanic Arts*, pp. 163-204. Brookings, South Dakota, 1920

The authors carried out 2 series of metabolism experiments on dairy cows with the object of comparing the availability of the proteins contained in linseed meal and gluten feed. Three cows were used in the first series which was continued in 1918 (though begun in 1917) ; it consisted of 6 periods of 10 days. The second series was begun late in 1918, and consisted of 4 periods : 4 cows were used. During the first series, the basal ration consisted of 30 lbs. of maize silage and from 11.59 to 16.65 lb. of prairie hay, and during the second series, of 20 lb. to 20.50 lb. of maize silage and 19.70 to 23.20 lb. of prairie hay. During the first period of each series, the basal ration consisted only of prairie hay and silage, and in every case, the nitrogen balance was negative. During the successive periods of series I, and in periods 2 and 3 of series II, linseed meal and gluten were in amounts which theoretically contained sufficient nitrogen to give the balance, but in no case was a positive nitrogen balance obtained.

The cows of the first series weighed respectively at the beginning of the first period 1153 — 1378 — 1040 lb., and those of the second series respectively 1043 — 830 — 936 — 864 lb. at the beginning of the first period. The results are set forth in 26 tables and are discussed; the literature referring to the subject is reviewed.

The percentage availability of the nitrogen has been calculated by 2 methods.

In the first, which is a modification of THOMAS's method, the increase in the amount of nitrogen assimilated during a period of feeding with concentrated food as compared with that digested when the basal ration alone was given, is expressed in % of the nitrogen available for accumulation in the organism and for catabolism. In the second, the increase of nitrogen used for milk production and for accumulation in the organism is expressed in % of the increase of the digested nitrogen. The following Table gives a summary of the data obtained by the second method; they agree very well with those supplied by the modified THOMAS method, according to the latter 52.4 % of linseed meal nitrogen and 76.4 % of gluten feed nitrogen were used on an average to establish nitrogen equilibrium.

The authors consider, that the fluctuations observed in the amount of nitrogen utilised are due to a great extent to fluctuations in the energy

Utilisation of the surplus nitrogen supplied for the formation of maintenance and milk production protein in relation to the concentrated feeds consumed and the energy afforded by the bulky feeds.

Concentrated feeds given during the successive periods (1)	In % of the necessary energy supplied by the bulky feeds					
	1917			1918		
	Cow No. 1	Cow No. 2	Cow No. 3	Cow No. 1	Cow No 2	Cow No. 3
Linseed meal	67.8 %	72.6 %	79.0 %	85%	97%	96%
» »	70.3	72.9	76.3	—	—	—
» »	66.16	77.6	73.2	—	—	—
Gluten feed	81.9	76.3	82.7	100	104	86
» »	91.2	83.9	89.0	—	—	—

Concentrated feeds given during the successive periods (1)	In % of surplus of available nitrogen used					
	1917			1918		
	Cow No. 1	Cow No. 2	Cow No. 3	Cow No. 1	Cow No. 2	Cow No. 3
Linseed meal	43.1 %	35.7 %	42.7 %	99%	87%	106%
» »	53.2	49.6	52.8	—	—	—
» »	39.9	44.5	37.3	—	—	—
Gluten feed	70.9	62.9	47.7	119	115	74
» »	76.9	77.4	67.9	—	—	—

(1) In the case of cow No. 3 of the 1918 series, the gluten feed period preceded the linseed meal period.

of the food ingested. When the percentage of therms furnished by the hay and silage was low, the protein in the gluten feed or linseed meal was used principally as a source of energy and could not be employed to build up the body tissue, or furnish milk protein. Therefore the percentage availability of the food-nitrogen was extremely low in these cases.

The order in which the different rations are fed also seems to have an effect on availability Although no concentrated feeds were given during the last period of the second series, the 4 nitrogen balances were positive.

The authors give Tables showing the approximative amount of foods fed during each experimental period and the quantities of nitrogen, fat, crude fibre, N-free extract, and ash ingested and excreted.

655 - **Observations and Experiments on Calf-Feeding in Italy.**— BRENTANA, D, in the *Riforma Agraria*, Vol I, No 12, pp 491-497, figs. 2; Vol. II, No. 2, pp. 82-83, figs 2. Parma, December 1920, February 1921

Observations made by the author in 1917 and 1918, at the Central Cattle Depôt of the 4th Army, where most of the calves produced by the cows in calf that had been seized by the requisition Commissions were being reared.

The following foods were used :— Whole milk, skim milk, hay, wheat bran, and limited amounts of sesame cakes and spoilt wheat flour.

For the first 4 or 7 days, the calves were fed by their dams; later, they were bottle-fed twice aday. A very simple form of bottle was used, the milk being given as soon as it was taken from the cow.

The effect of very prolonged suckling and weaning, for 107 and 127 days respectively, was tried upon 3 calves (2 males and 1 female) of the brown Alpine breed.

When the animals were about 3 days old, they were given a little hay of excellent quality grown on a permanent pasture; from the 108th day, small but continually increasing, quantities of bran were fed.

The results are given in the two following Tables.

TABLE I. — *Calf-Feeding Experiment.*

	Periods	Duration (days)	Live weight		Increase in live weight		Whole milk consumed	Hay consumed	Bran consumed	Digestible nutrients consumed for an average increase of 1 kg. in live weight			
			initial	final	Total during the period (3 calves)	Average per day (3 calves)				Protein	Fats	Estimate	Starch value
			Kg.	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.	Gm.	Gm	Gm.	Gm.
Suckling . .	I milk alone	34	115	219	104	3.058	811.30	—	—	257	266	359	1 148
	II milk + hay	73	219	448	229	3.13	2356.00	96.00	—	362	354	643	1 646
Weaning . .	III	127	448	845	397	3.12	2271.00	753.40	337.65	389	238	1 373	1 791
Totals . .	—	**234**	—	—	**730**	—	**5438.30**	**849.40**	**337.65**	—	—	—	—

TABLE II. — *Economic results (in lire)*

	Periods	Cost of milk	Cost of hay	Cost of bran	Cost	
					total	expressed per increase of 1 kg in live-weight
Suckling	I milk (alone)	811.30	—	—	811.30	7 80
	II milk + hay	2356.00	48.00	—	2464 00	10.49
Weaning . .	III	2271.00	376.70	270.12	2817.82	7 10
Totals . .	—	**5438.30**	**424.70**	**270.12**	**6033.12**	—

Cost of foods per quintal: Whole milk 100 fr.; hay 50 fr ; bran 80 fr

The cost of the food consumed to produce 1 kg. of live-weight was 8.26 fr., to this about 50 % must be added, in order to obtain the total cost of production. Under the conditions prevailing in the Parma market towards the end of 1920, the total cost amounted to 12.39 fr. per kg. of live-weight.

The milk represents 90 % of the cost of calf-rearing. Owing to the high cost of milk-production, the author advises that his rearing systems should not be adopted for butcher's animals, but only for breeding cattle.

Weaning should always be progressive, and ought to last at least 1 month. Good practical results have been obtained by allowing the suckling + weaning period to last 4 months The author obtained quite satisfactory results when it was reduced to 3 months In the first case, if the calves, after weaning, were chiefly given hay and bran, their usual live-weight on their reaching the age of 270 days, was over 2 quintals.

656 - **Plant Foods Rich in Protein Replaced by a Digestible Form of Animal Epithelial Products in Rations Fed to Wool-Producing Sheep; Experiments Carried out in Germany.** — ZUNTZ, N., in the *Biedermann s Zentralblatt*, Year XLIX, Part 5, pp 189-190. Leipzig, May 1920.

A means of increasing wool-development in sheep without the use of foods with a high protein content (1).

As is well-known, sulphur-containing cystine, an albuminoid derivative, is the substance chiefly concerned in the growth and development of wool. Only 0.3-2 5 % of it is to be found in the protein of nutrient liquids, and it sometimes occurs in even smaller quantities in protein food substances, whereas the cystine content of the horny constituent of wool is as much as 7.3 %. Thus, in order to obtain the necessary amount of cystine, considerable quantities of protein have to be ingested. Further, it has been found, that after the decomposition of the protein and the elimination of the cystine, all the other matters that make up food protein are lost, as regards the formation of animal albuminoids, which explains the relatively large quantities of protein required in the ration, in order to obtain a good wool-yield from sheep.

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(1) See *R.*, Oct. 1920, No. 1015. (*Ed.*)

As foods rich in protein are lacking in Germany, the author, with a view to economising plant proteins, tried to give sheep all the nutrients required for inducing the growth and development of their wool by adding to their rations, hair and other epithelial products that had been rendered digestible by chemical action. The results of the experiment were satisfactory ; 4 sheep were given equal amounts of disintegrated straw and mangolds, the quantity being sufficient to maintain the weight of the animals.

Of the 4 sheep used in the experiment, 2 were given from 9-10 gm. of digestible horn in their rations per head per day.

After the experiment had lasted for four months, the fleeces, of these animals, were much finer than those of the sheep which had been given no horn, and microscopic examination showed that the diameter of the staple exceeded by one-third that of the wool produced by the control animals.

657 - **Compulsory Keeping of He-Goats by the Communes in Prussia.** — GERRIETS, J. (Regierungs und Landesökonomierat), in the *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No 34, p 259 Berlin, 1921

Law of December 14, 1920 relating to the compulsory keeping of he-goats by Prussian Communes and the compulsory licensing of he-goats kept for public service (1). Goat-breeding in Prussia, on account of the altered economic conditions, has increased to such an extent of late years, that is has become an important industry. Whereas, in 1913 there were only 1 910 888 goats (2), the census of 1919 showed that there were 2 475 609. The milk-yield has, however, not increased, but rather diminished owing to the animals having been insufficiently fed, and to the use of unsuitable service goats.

On the other hand, the number of he-goats kept by private initiative and possessing any value for breeding purposes is very small, owing to the expense of purchasing and keeping them. Therefore, suitable male goats have to serve too many females, and frequently the latter are mated late or even not at all. The above-mentioned law regulating the keeping of he-goats in all the Prussian provinces is intended to remove these difficulties. The two main points insisted upon are as follows :—

1) Inasmuch as the number of he-goats kept in the commune by private persons is not sufficient to meet all requirements, the Commune is required to purchase and maintain as many of the said animals as are required to serve the female goats kept in the Commune. The law allows one male for the service of 80 female goats.

2) Any keeper of goats intended for public service is required to use licensed animals only.

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(1) *Preussische Gesetzessammlung* 1920, p. 263. (*Author*)

(2) Reckoning according to the present area of Prussia. (*Author*)

The law contains no special provisions for the licensing of service goats; but leaves the matter to be settled by the Regierungspräsidenten after consulting the Chambers of Agriculture of the several districts.

As a considerable number of goats are kept in the towns, a special clause has been inserted in the law making this regulation apply also to town districts.

In South Germany, the keeping of he-goats has been regulated for some years by similar enactments. In the Prussian province of Hesse-Nassau, a similar law, which has produced excellent results has been in force since 1909 (1).

658 – **Pig-Breeding in the Marches, Italy** (2). — BARTOLUCCI, A., in the *Giornale di Agricoltura della Domenica*, Vol. XXXI, No 17, p 131, figs. 3. Piacenza, April 24, 1921.

The live-stock census taken in April, 1918, showed that there were then 2 388 926 pigs in Italy, as against 2 507 798 in April, 1907. Although the total for the whole country had decreased, the pigs in the Marches had slightly increased, the return for that district being 116 689 in 1918.

The native pig of the Marches is descended from the old Iberian breed, (which is the origin of all the Italian varieties and sub-varieties) and is the result of interbreeding local animals with those from Umbria, Tuscany, Romagna and Campania Of late years, in some districts, crosses have been made with the Yorkshire and Berkshire breeds. The indigenous variety is still found relatively pure in the mountainous part of the region and even more frequently in the Province of Macerata.

These animals have black coats shading off into slate-grey, the skin of the abdomen and of the interior of the thighs being reddish; they are frequently more or less spotted with red. Though this variety has rather long legs, a slightly elongated groin, and is laterally compressed, it is however very voracious and has great digestive capacity, matures remarkable early, is fairly and constantly prolific, and though their hygienic and food conditions often leave much to be desired, the sows have wonderful powers of suckling their young. The meat and fat of these pigs are much prized as was shown at the Pig Show held at Tolentino on March 17, 1921. The pig-breeders of the Marches therefore propose to preserve the native type and improve it by selection and better methods of breeding.

659 – **Effect of Age of Pigs on the Rate and Economy of Gains.** — ROBISON W L, in *Ohio Agricultural Experiment Station, Bulletin* 335, pp. 545-575, 12 figs. Wooster, 1919

Five experiments are here described In the 3 first, the author studied the development and food consumption, from their birth, of 3 lots of uniform pigs, with the object of determining the amount of feed consumed per unit of increase in weight until the weight of 500 lbs. was attained. Pure-bred Duroc-Jersey barrows were used shortly after weaning and were fed separately; in determining the feed per pig from farrowing to weaning, the average of the total feed consumed by sow and litter was taken. The pigs used in the first experiment were born in the spring, those of the other 2 experiments were born in the autumn. The pigs of the first experiment were given 10 parts of ground maize, 4 parts of middlings and 1 part of tankage by weight, from the time they were weaned (at the age of 3 weeks, that is to say, as soon as they could eat) until they were slaughtered. The ration of the pigs used in the second and third experiments consisted of maize and tankage, at first in the proportion of 8 :1, later, in the 24 following weeks, the maize was gradually increased to the proportion of 14 :1 at which it then remained.

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(1) *Preussische Gesetzessammlung*, 1909, p. 675. (*Author*)

(2) See *R*, July-August, 1920, No 779. (*Ed.*)

As soon as the increase in weight attained 100 lbs., some pigs of each lot were killed, in order to ascertain the weight and quality of the carcasses. The following table gives the results for the first and second experiments.

Effect of weight on rate and economy of gains.

	Number % pigs	Average Number % days required	Initial weight per pig	Average daily gain	Average Daily feed		Feed per lb v ,		Average dressing per cent.
					Per pig	Per 100 lb weight.	maize	tankage	
			lb.	lb.	lb.	lb.	lb.	lb.	
From birth to 100 lb weight	27	144	2.63	0.829	2.112	4.14	—	—	77.7
» 100 » 200 lb. »	22	200	99.90	4.17	5.938	4 93	3.17	0 28	83.4
» 200 » 300 lb »	17	254	201.97	1.809	7 181	2 85	3.71	0.28	87.6
» 300 » 400 lb »	12	312	301.00	1.719	7.763	2 21	4 25	0 30	88.2
» 400 » 500 lb. »	5	363	402 29	1.579	7.817	1 72	4.60	0.33	88.2

The pigs of the first lot gave the same general results. The number of days required to produce each successive 100 lb. of gain was 125 — 152 — 230 — 286 — 362. The amount of feed per lb. gain was 2.89 — 3.36 — 3.70 — 3.97 — 4.43 lb. in the successive periods of development.

The estimates of the gains show that there is less profit (difference between the sale price of the animal and the cost of food consumed) when pigs are kept beyond the age of quickest growth than when they are sold before the rapidity of growth begins to decrease.

The weight at which it is most profitable to sell pigs full-fed from birth is influenced by ; the method of proportioning the supplemental feed — the amount of the latter — the relation of the price of the supplemental feed to that of maize or other carbonaceous feed — the relative price of feed — the market value of hogs. The live-weight at which it pays best to sell pigs for slaughter was larger in the case of the lots in which the proportion of suppplemental feeds was gradually reduced (viz. those of the 2nd and 3rd experiment) than in that of the lot where this proportion remained constant (animals of 1st lot).

In the 4th experiment, which was carried out in duplicate, the results in both cases being the same, 2 lots of pigs weighing on an average 35.5 lb. per head were compared. Both lots of animals were on rape pasture, the first received a full ration of maize during the three periods of the experiment (each lasting 7 weeks) and the second a limited amount, viz. 2 to 3 lb. daily per 100 lb. of live weight for the first two thirds, of the test and a full feed for the last third. At the end of the first 14 weeks the second lot were not so fat nor in such good condition as the pigs of the first, but during the last 7 weeks they gained weight more rapidly than the others. The amount of concentrated food they consumed per unit of gain was 13 % lower than that of the pigs of the first lot.

The 5th experiment lasted for three periods of 6 weeks each and was a dry-lot feeding test in which narrow, medium, and wide rations of maize were given. The medium ration contained approximately half as much tankage as the narrow one, and the wide ration half as much as the medium one. In all three rations, the proportion of tankage to maize was decreased each week.

For the first and second periods, the pigs fed the most tankage made the most rapid gains and required the least feed per unit of increase in live-weight. For the third period, however, they grew more slowly and required more feed per unit of gain than the animals of either of the other two lots.

660 – **Bee-Keeping in French Guinea.** — (Procès-verbal de la Seance Generale de la Société Nationale d'Acclimatation de France du 24 Janvier, 1921). *Bulletin de la Société Nationale d'Acclimatation de France.* Year LXVIII, No 5, pp 76-77, Paris, May 1921.

Bee-keeping, which was an industry having formerly only rudimentary means at its disposal, in the colonies of French West Africa, now seems to be making satisfactory progress. In spite of the indolence of the natives, the Authorities of French Guinea, have succeeded in persuading them to adopt an improved type of hive, whilst the advice given to the native bee-keeper, has borne good fruit, for whereas 28 metric tons of wax were exported in 1910, the maximum since then has been over 213 tons, and up to 1920, about 200 tons had been shipped annually. Only 75 tons were exported during the first 9 months of 1920, but it is probable that this decrease is only temporary, and that the production of bees-wax in the Colony will soon assume its former proportions, and progress as heretofore.

661 – **Experiment on the Influence of Waterfowl on the Yield of Fish, in Germany.** — WELLERT, P, in the *Mitteilungen der Fischerei-Vereine fur die Provinzen Brandenburg, Ostpreussen. Pommern,* Vol XIII, No. 5, pp. 70-73. Neudamm, May 1921.

VOGEL (1) in his work *Lehrbuch der Teichwirtschaft* had previously drawn attention to the importance of waterfowl for increasing the yield of fishponds, notably owing to the production of a manure containing a proportion of nitrogen and phosphorous, thus providing a regular manuring of summer ponds. The author, wishing to determine the effect of keeping waterfowl combined with pisciculture on the yield of fish in carp ponds, carried out experiments lasting from 1906 to 1920, during which period the yields of two development ponds were carefully registered.

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(1) P. VOGEL, *Lehrbuch der Teichwirtschaft,* Emil Hubner, Bautzen, 1904 (*Author.*)

During the years 1906-1910, the two ponds, with respective areas of 1.53 and 0.89 hectares were without waterfowl; in 1911-1915, 2000 tame ducks and 200 geese were kept on them. The birds were housed near one of the ponds and let out when about six weeks old. In 1915, the keeping of fowl had to be given up owing to scarcity of food, so that during 1916-1920 the ponds were entirely without fowl.

Increase in weight of fish per morgen (25.532 *ares*)
from 1906 *to* 1920.

	Development pond I Area 1 53 hectares Increase in kg	Development pond II Area 0 89 hectares Increase in kg.	Average increase of fish during a period of 5 years	
			Pond I kg.	Pond II kg.
1906	113 50	59.00	115.60	94.00
1907	101 50	124.00		
1908	113 00	176 00		
1909	138 50	76.00		
1910	62.00	35.00		
1911	229.50	143 50	259.60	209.15
1912	273 00	268.00		
1913	351.00	291 00		
1914	215.50	127 00		
1915	229.50	217.00		
1916	146.50	57 00	106.00	89.10
1917	136.00	39.00		
1918	234.50	123.00		
1919	87.50	98 00		
1920	180.50	129 00		

According to the author, the decrease in yield during the years 1914-1915 was due to a reduction in the number of fowl in August, 1914; he also explains the higher yield of pond I as due to the greater proximity of the fowlhouse to that pond.

Regarding the modifications in the microflora and microfauna of the ponds due to the waterfowl, quantitatve analysis of the plancton showed that, during the years 1911-1915, the ponds were richer in plancton than in the years 1906-1910 and 1916-1920, and, moreover, emerged plants completely disappeared but grew again after that period.

On account of these encouraging results the author recommends the application of this method, but only allowing the fowl access to the development ponds, as they do too much damage in the spawning ponds and those in which the young fry are kept.

[661]

FARM ENGINEERING

662 - Progress of Power-Farming in France. Institution of a Central Committee of Mechanical Cultivation and Establishment of Experimental Stations (1). — I. *Journal officiel de la Republique Française*, Year LIII, No 32, pp. 1524-1530 Paris, Feb. 2, 1921; II. *Ibid*,. No 126, p. 5626. May 11, 1921.

I. — *Progress of power farming.* — Report by J. H. Richard, Minister of Agriculture for France, on the arrangements made to encourage mechanical cultivation, consisting in subsidies granted to groups or syndicates formed for the acquisition and use of motorculture machines, tractors and ploughs. The subsidies varied from 35 to 50 % of the purchase price of the machines during the three years 1916, 1917, and 1918.

The report, which deals with these three years, gives detailed statistics which may be summed up as follows:— In 1916, 29 machines were subsidised; their purchase price was 217 462 fr. and the subsidies amounted to 66 650 fr. In 1917, the number of machines subsidised reached 519 costing 2 818 323 fr., and 1 011 224 fr. was paid in subsidies. In 1918, 381 machines costing 6 464 530 fr. were subsidised at a cost of 2 999 300 fr. Out of the 605 machines which figure in the statistics, only 10 were constructed in France. However, since then the situation has considerably altered.

In 1920, subsidies were applied for on 664 machines of which 246 were of French and 418 of foreign make. The report adds that from January 1, 1918, to December 31, 1919 subsidies amounting to 13 306 219 fr. were granted for the purchase of 1 793 machines of which one was an electrical tillage apparatus. Further it appears from the examination of other applications recived late at the Ministry, that the subsidies would reach 34 340 000 fr. including 12 000 000 fr. for the interior and 22 340 000 fr. for the liberated regions.

II. — *Law of May* 10, 1921, *relating to the institution of a Central Committee of Mechanical cultivation and the creation of Experimental Stations in France.*—

Article I. — A Central Committee of mechanical cultivation is instituted at the Ministry of Agriculture for the investigation of machines for mechanical cultivation. It shall be presided over by the Minister or his delegate and will be composed of: — The Director of the Station for testing agricultural machinery; two professors of the National Institute or of the National Schools of Agriculture; four specialist professors or engineers chosen either from the Central Schools of Arts and Manufactures (construction and working machinery), or from the Schools of Arts and Crafts; and one Inspector General of Farm Engineering (for electrical apparatus).

There shall be associated with this Committeee: — One representative of the Committee of French motor culture, one representative of the Committee of Manufacturers of Agricultural machinery, one representative of the Committee of Manufacturers of automobiles, one representative of the Committee of Importers of foreign machinery and four farmers nominated by the Minister.

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(1) See R, July 1917, No 650 (*Ed*)

Art. 2 — The land required for the establishment of a Central Experimental Station shall be placed at the disposal of the Committee for its experiments and research.

Art. 3 — Secondary Experimental Stations for motor culture may, after approval by the Higher Council of Agriculture and in agreement with the Committee, be established at the request of Chambers of Agriculture or of Regional and Departmental Agricultural Services.

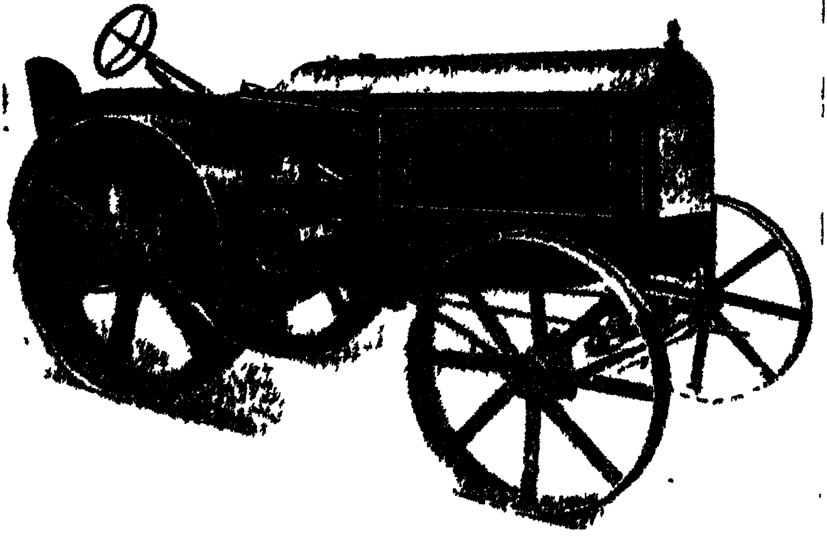
Art 4. — A decree made on the motion of the Minister of Agriculture and of the Minister of Finance shall settle the conditions under which the Central Committee of mechanical cultivation shall act, and shall determine the organisation of secondary Experimental Stations

663 - **Mechanical Cultivation of Rice Fields.** — See Nos 623 and 624 of this *Review*.

664 - **The "Uncle Sam" Tractor.** — DESSAISAIX, R., in the *Journal d'Agriculture pratique*, Year 85, No 15, pp 295-296, 1 fig Paris, Apr 16, 1921

The tractor known under the name "Uncle Sam" was shown by Messrs MATHIEU & Co (55 Rue de Prony, 17e) at the recent exhibition of apparatus for mechanical cultivation at Vincennes, Paris

The machine, illustrated in the figure below is provided with a 4 vertical cylinder motor (0 120 bore and 0.152 stroke), of a good American make, with valves placed on the base of the cylinders and controlled by levers protected by a hood The motor works at 900 revolutions per minute;



The "Uncle Sam" tractor

it is furnished with a speed regulator and runs on paraffin, after starting for a few seconds with petrol. The motor has a 29 H. P. brake working at 26 to 27 HP, the consumption per HP, and per hour amounts to 0.40 litres with paraffin and 0.47 litres with heavy oil. working with paraffin is much more economical in the quantity consumed and in cost.

The motor is cast solid with the gears and gear box and is separate from the frame of the tractor.

The front axle, mounted on a joint and transvers spring has wheels 0.92 m.) in diameter, 0.15 m. width of rim and separated (track) 1.73 m. from each other.

The drying wheels (diameter 1.27 m., width of rim 0.30 m., track 1.07 m.) are fitted with angle pieces when working in fields. The track of the back wheels is narrower than that of the front wheels. The pressure of the wheels on the ground is very slight, viz., 26 kg. per cm. of width of rim of the front wheels and 20 kg. for the back wheels.

The forward speeds are about 4000 and 6000 m. an hour, and the reverse is 2800 m. an hour.

The wheel base is 2.17 m. The principal dimensions are: Length 3.65 m., width 1.89 m., height 1.60 m. The total weight, 2081 kg., is divided shus: — 807 kg. on the front wheels and 1274 kg. on the back wheels. This tractor is very interesting, like all those which can use paraffin, a more economical fuel than petrol.

665 - **Clearance and Upkeep of Firelines by Tractors.** — See No. 640 of this *Review*

666 - **Coupling Binders to Tractors.** — RINGELMANN, M., in the *Journal d'Agriculture pratique*, Year 84, No 27, pp 14-16, figs. 4. Paris, July 1, 1920; No 28, pp 33-35, figs. 3. July 8, 1920.

In principle the coupling of a binder to the tractor should be done in such a way that the man sitting on the binder, whilst seeing that the machine works properly so far as reaping and binding are concerned, can also guide the reaper in spite of any deviations in the horizontal plane which the tractor may happen to make, so that omissions in reaping may be avoided and the edge of the crop to be cut may be straightened.

When the tractor is only drawing one binder, these arrangements are not important, for the driver of the tractor quickly learns to guide the machine, to move it quite in parallel to the edge of the crop and at the desired distance from it; the long shaft of the binder *M* (fig. 1) is replaced by a shaft *Q*, about 2 m. long, coupled at *f* directly to the tractor and furnished, like the shaft, with a support and a connecting rod *h* for levelling the teeth of the blade. Special coupling arrangements are indispensable when reaping is done with 2 or 3 binders attached one behind another and all having to be moved to the side of the blade; lastly, in case of a breakdown in one of the binders, it is necessary to be able to put it out of the line without hindering the work of the binder attached behind it.

To obtain this result, the posterior end of the shaft is jointed to the structure of the reaper and binder, so that the angle, in the horizontal plane, made by the pole with the blade carrier, and consequently with the driving wheel, can be modified at will; at the same time, to avoid straining the structure of the binder, a traction bar joins the joint of the pole with the back of the binder frame and the posterior end of this bar takes the coupling of the pole of the next reaper and binder.

The principle of these mechanisms designed for reapers and binders applies also to mowers when two or three are drawn by one tractor. However, as all these machines (reapers and mowers) work to the side, the more their number is increased, the more the couple resulting from their attachment, which tends to make the tractor deviate, is increased; also turning becomes increasingly difficult when the tractor draws a greater number of harvesting machines, unless cutting is confined to the two long sides of the crop by turning in a large curve without cutting on the two short sides of the field widely cleared of the crop.

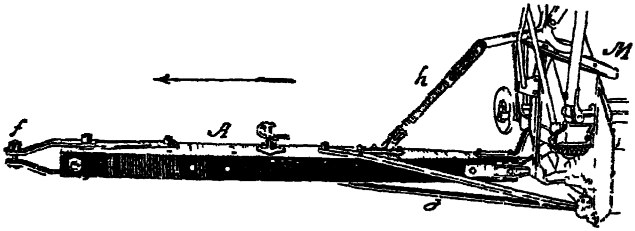


Fig. 1. — Coupling pole of a reaper and binder.

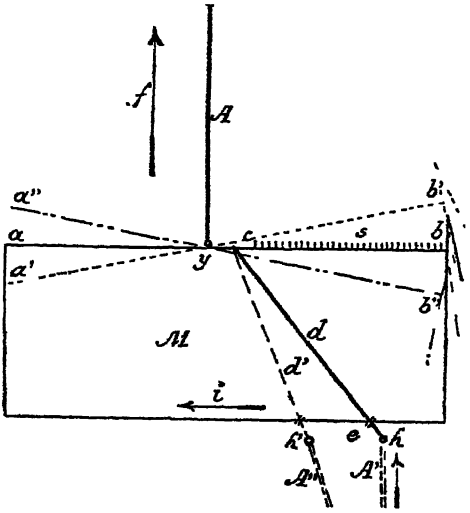


Fig. 2. — Steering of a binder attached to a tractor.

In relatively small fields the cost of taking a round-about turn for the use of several binders working simultaneously absorbs all the saving which might result from the work of 2 or 3 binders drawn by the tractor.

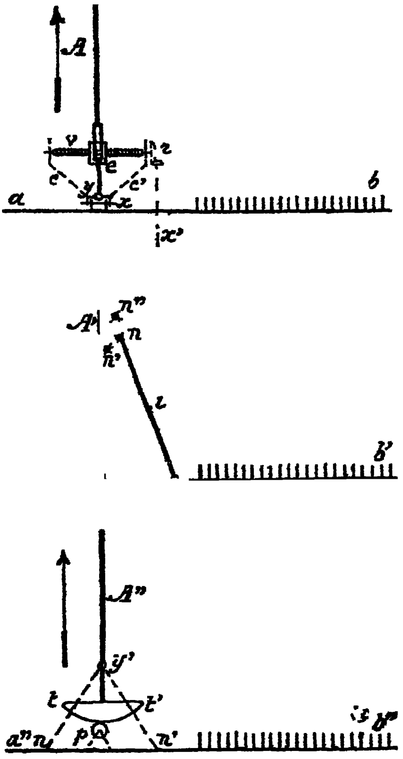


Fig 3 — Principle of some arrangements for slanting the pole of a binder.

With reference to fig. 2, representing diagramatically the horizontal projection of a binder *M*, cutting on the right, the blade carrier of which is situated on the transverse member *ab*, on which the pole *A*, pulled in the direction of the arrow *f*, is jointed at *y*, the angle *Ayb* may be considered. If by suitable means the driver decreases the angle *Ayb*, the transverse member *ab* takes the position *a'b'* giving the binder a tendency to turn to the left, thus diminishing the cutting length of the blade *S*. When the angle *Ayb* is increased the transverse member *ab* slants in the direction *a'b'* giving the binder a tendency to turn to the right, cutting over a greater width

In fig 2, the pole *A* is shown perpendicular to the transverse member *ab*, a position only used when a single binder is attached, for the 2nd and 3rd machines the pole *A* is always oblique and the angle *Ayb* is obtuse so as carry back the point of coupling on the to preceding binder from *h* to *h'*.

Various arrangements are used for altering the angle *Ayb* of fig. 2 while moving. Sometimes a horizontal screw *v* (fig 3) is used which can, in turning, move a nut fixed to the pole *A* jointed at *y* with the structure *cc'* shaped in an isosceles triangle jointed itself at *x*, in avertical plane, with the transverse member *ab* constituting the front cross-piece of the frame of the binder, the frame *cc'* carries the connecting rods which level the teeth of the blade The screw *v* is worked by the conical gearing *r* and the axle *x'* (1) turned either way by the driver of the binder.

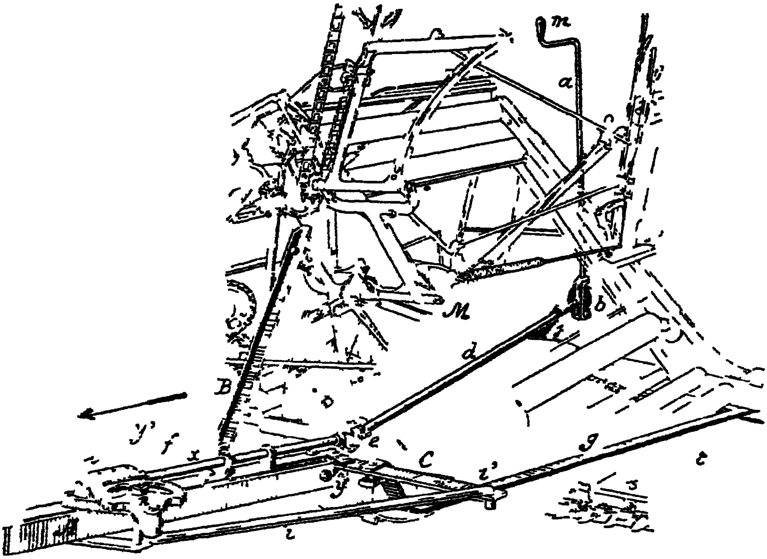


Fig 4 — Mac Cormick device

In other arrangements, there is an inextensible connecting rod *l* (fig. 3) jointed at *i'* to the transverse member *a'b'* and whose extremity *n* can move from *n'* to *n''* relatively to the pole *A'*

In other cases, the posterior end of the pole *A''* carries a toothed sector *tt'* which can turn a pinion *p* whose axis is fixed to the transverse member *a''b''* ; in this case the pole *A''* pivots round the axis *y'* (geometric axis of the sector *tt'*) attached by the frame *ny'n'* to the transverse member *a''b''*

Lastly (fig 2), an oblique traction bar *d*, held in front by the cross piece *yc* and behind, on the structure of the binder by a hook *e*, takes, at *h*, the coupling of the pole *A'* of the next binder, which is drawn by this bar *d* and not by the frame of the machine *M* ; however, owing to the obliquity of the bar, the crosspiece at the back of that structure has a tendency to be displaced in the direction of the arrow *i* by putting the horizontal frame of the platform out of shape. This force *i* is reduced by moving the bar to *d'*, consequently the point of coupling *h* to h', and by the slanting, in the direction A', the pole of the binder attached behind the machine *M*.

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(1) This arrangement is found in the Massey-Harris mechanism, 138, Avenue Jean Jaurès, described in the *Journal d'Agriculture pratique*, No 12, p 2297, 1920 (*Author*)

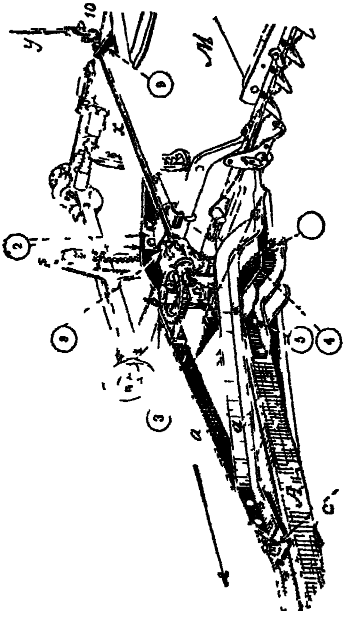


Fig. 5 — Deering mounting

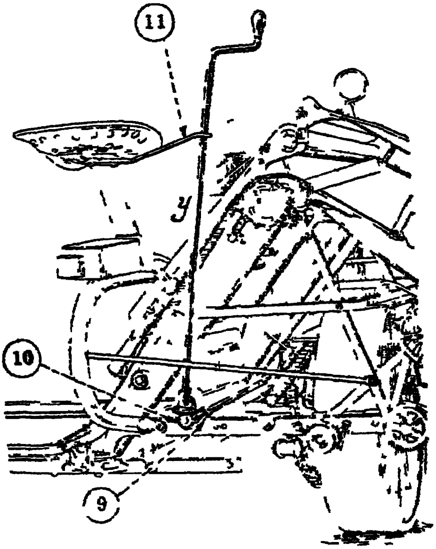


Fig 6 — Back view of a Deering reaper and binder, with the steering handle

In the Mac-Cormick apparatus, of R. Wallut & Co. (168 Boulevard de la Villette, Paris) shown in detail in fig. 4, the pole *A* is jointed at *v* with the front of the frame of the binder *M* (in the plan on the left) a portion of whose blade carrier is seen at *s* The balance of the binder *M* in a vertical plane parallel to the driving wheel is ensured by the angle-iron *B* ; the latter is jointed below to the pole *A* and above to a crank which moves the levelling lever allowing the platform *t* to be inclined and the teeth of the blade carrier *s* to be brought nearer the ground, to a greater or less degree, so as to alter quickly the position of the blade and the height of the cutting.

The crosspiece *C* being fixed to the structure of the binder, steering is obtained by altering the horizontal angle which the pole *A* makes with the crosspiece *C*. For this purpose, the driver has within reach the crank *m* of the vertical axle *a* which, by means of a bevel gear *b* (pinion controlling a wheel) moves the slanting axle *d*, the cardan joint *e* and the shaft *x*, the front end of which carries an endless screw (covered by the plate *v*) which controls the toothed sector *n* which can turn on the shaft *y'*; the sector *n* carries a crank stud *f* to which is jointed the connecting rod *i*, the end *i'* of which is in turn jointed to the crosspiece *C*, that is to say to the structure of the binder; the horizontal movement of the point *f* alters the angle *Ayi'*, and consequently the plane of the driving wheel of the binder relatively to the pole *A*.

The support for the shaft *d* is seen at *j* (fig. 4), and *g* is the slanting bar attached to the front crosspiece *C* for transmitting the tractive force of the pole *A* to the next binder.

In the DEERING mounting, of the Compagnie Intrnationale des machines agricoles (155, Avenue du Général Michel-Bizot, Paris), the principle indicated at *A''* in fig. 5, is used. The crosspiece in front of the binder *M* (fig. 5) is fitted with the triangle *a*, 3, 2 made of angle iron carrying at *c* the vertical axis of the joint of the pole *A*, the end of which is fixed to a toothed sector 4, 7, kept in place by the bolts 5. The sector is moved by a pinion fixed to the wheel *b* driven by the endless screw *v*, the cardan 8, the shaft *x*, supported at 9 and ending in conical gearings 10 which transmit the movement from the vertical axle *y*. The latter is seen again in fig. 6 which gives the back view: the shaft *y* with crank *m* is supported by the cross bar 11 bolted to the seat pillar.

The arrangements described above are applicable when it is desired to attach 2 or 3 binders (or mowers) to one tractor; when only a single machine is used, a simple pole suffices.

667 - **Regulating Double Brabant Ploughs.** — RINGELMANN, M., in the *Journal d'Agriculture pratique*, Year 85, No. 6, pp 114-116, figs. 3. Paris, 12, Feb. 1921.

The stability of the double brabant plough, for given dimensions of the strips of soil ploughed, is effected by the correct position of the furrow wheel and of the yoke hook.

With reference to figure 1, which illustrates the principle of the support of a double brabant plough, with the lifting mechanism at *y*, the axis of the beam is shown at *o*, the wheels *R* whose plane of rotation is on *gr* the rings or washers *b* placed on either side of the hub of each wheel, the lengths *u* and *u'* of which are unequal on each side so that the wheel may be turned round on its spindle, a condition which entails the use of wheels other than the carriage type and bad lubrication of the naves, which cannot be kept suitably oiled.

For a given depth of ploughing, *mr* (fig. 1) and a width *l*, the rim of the wheels *R* should run in the angle formed by the face *mr* with the bottom of the furrow, the yoke hook being arranged to give the plough a slight tendency to go wide; on the other hand the plane of the supports should be perpendicular to the surface *gl* of the ground, and as the wheels run alternately on the fallow and in the furrow, the distance between them *E* or the lenghts *a*, *n*, and *d*, are thus determined by the dimensions of the strip of soil to be turned over

If the depth of ploughing is modified, by altering the height *h* of the beam above the axle, by adjusting the lifting mechanism *y* (or of a lever in the other model), it is necessary, to ensure stability, to modify the distance *E* between the wheels by using the washers *b* which are moved with reference to the nave.

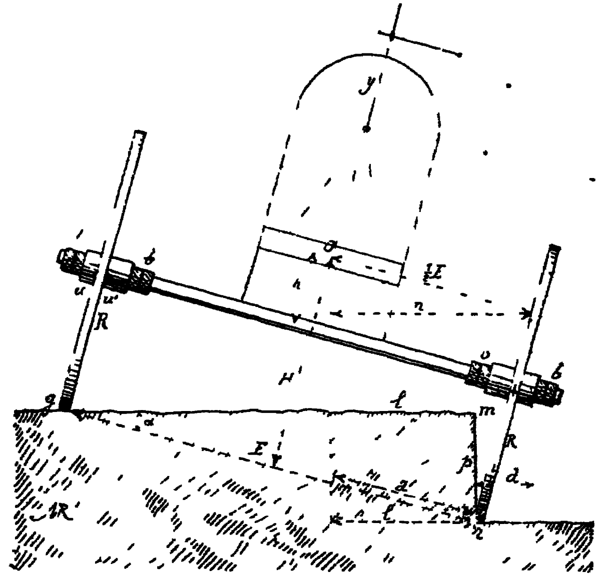


Fig 1 — Front view of the support of a double brabant plough with a lifting mechanism

In regulating the double brabant the ploughman makes successive tentative alterations He first tries to regulate the depth, then he brings the plane of the supports into position (that is to say he modifies the angle *x* of fig. 1), so that it is perpendicular to the surface of the ground, by moving the catches into which the bolt fits which fixes the beam to the support; he next regulates, by means of the washers, the position of the furrow wheel so that its rim rubs lightly, but constantly, the bottom of the face of the furrow; lastly he alters the yoke hook so that the furrow wheel may run under the conditions indicated above. Often the ploughman does not take care in regulating and exaggerates the pressure of the wheel against the face of the furrow, thus increasing the traction effort on the team.

After these adjustments, the double brabant is regulated for one side of the plough; returning in the next furrow the ploughman makes similar adjustments for the other side of the plough

In consequence of tests made by the author in 1896 (*Journal d'Agriculture pratique*, 1896, Vol. I, p. 902) showing that the bad state of lubrication of the wheels caused rapid wear of the spindles, wheels with grease boxes (called " demi-patent ") were made, mounted on an axle in two pieces so that the wheels could be symmetrically separated or brought nearer each other as required. The author also says that the rims of the wheels should be made of iron with a semi-elliptic section in order to increase the stability of the plough by decreasing the resistance of the wheel to traction.

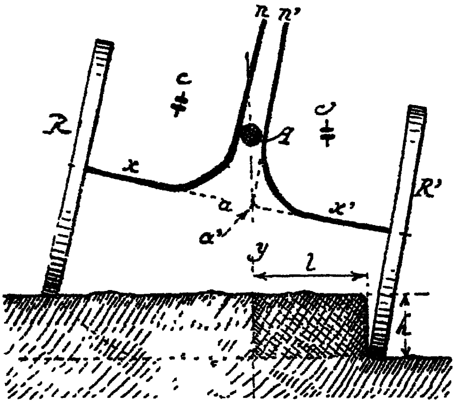


Fig. 3. — Louis Champonnois device for regulating double brabants.

In the device suggested by Louis Champonnois, agricultural engineer, of Villiers-le-Sec par Ceully (Calvados), modification in the depth of ploughing acts automatically on the distance between the wheels supporting the double brabant.

The wheels *R* and *R'* (fig. 2) are mounted at the ends of bent axles *xn* and *xn'*; the arms *n* and *n'* are fixed to the catches indicated schematically at *c* and *c'*. in which fits the bolt which fixes the beam *A* relatively to the wheels; in figure 2, the plane of the supports is shown at *y* and the beam *A* is at such a level that the plane of action of the ploughshare is at ground level *s*, that is to say that the plough, which is not working, is arranged for placing on its transport waggn. The wheels *R* and *R'* are inclined about 10 degrees from the vertical; the prolongations of the arms *n* and *n'* to intersect the prolongations of the axles *x* and *x'* meet them at *a*.

Figure 3 shows the position of the parts, previously referred to, when the depth of ploughing is *h* and the width *l*, *y* being the plane of the support perpendicular to the surface *s* of the fallow; the correct position of the two wheels *R* and *R'*, the furrow wheel having to keep always touching the face of the furrow so as to assure the stability of the plough, is obtained by separating the points *a* and *a'*, the beam *A* then being nearer the ground *s* by a distance sufficient to give a depth of ploughing *h*. By working the lifting mechanism the points *a* and *a'* are made to separate from or approach one another in such a way that the distance between the wheels *R* and *R'* is thus automatically regulated, which ensures the maintenance of the plane of the supports on the line *y* perpendicular to the surface *s* of the ground without any need of altering the position of the catches *c* and *c'*.

The lifting mechanism can act either by bringing the ends of the arms *n* and *n'* nearer to each other, or, which seems simpler, by separating the points *a* and *a'*.

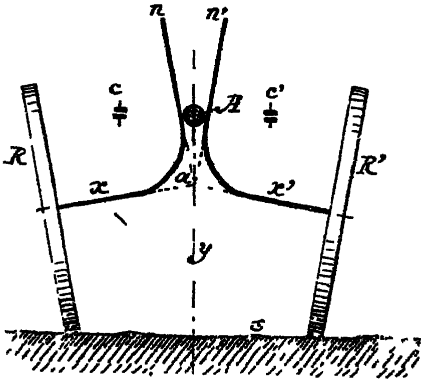


Fig 3 — Front view of a double brabant at work, fitted with the CHAMPONNOIS support.

668 - The Marciandi-Porta Rotary Digger. — TARCHETTI, A., in the *Giornale di Risicoltura*, Vol XI, No 1, pp 5-13, 5 figs Vercelli, Jan 31, 1921

The working of this machine, which the author has tested on several occasions in the field, is cinematic and similar to that of ordinary rotary tillage machines The digging part or spiked-beam, is composed of 4 pairs of spades mounted on the same horizontal axle in the form of hoods and digging a total width of 1.60 m., the digging wheel is raised (for turning and travelling by road) and lowered by means of a lever, which also regulates the depth of digging, within certain limits determined by the diameter of the digging mechanism.

The appended figures show how the digger is attached to the tractor and how the spades work

Each spade is composed of 2 flat, vertical, steel blades, scythe shaped with the concave part cutting; to each of them is fixed, at right angles to the convex edge, another curved blade which does not end at the point of the beak but a little behind it, where it has a retreating and cutting edge: each spade is therefore composed of two halves, each composed of 2 cutting edges one of which cuts the ground in a direction parallel with the direction of the tractor and the other transversely. As the 2 flat blades are 40 cm apart (width of clod), and as the curved blades each project 15 cm., there remains between the latter a space of 10 cm. corresponding to which the earth is not cut by the blades but is torn up owing to cohesion with the rest of the clod already cut. This space is required to give room, at the middle of the halves of the spade for support to a kind of screen or diaphragm (on the right in fig 1) fixed to the frame of the machine and intended to stop the clod of earth cut and lifted by the spade in its rotation and to cause it to fall back turned over when it is separated from the spade

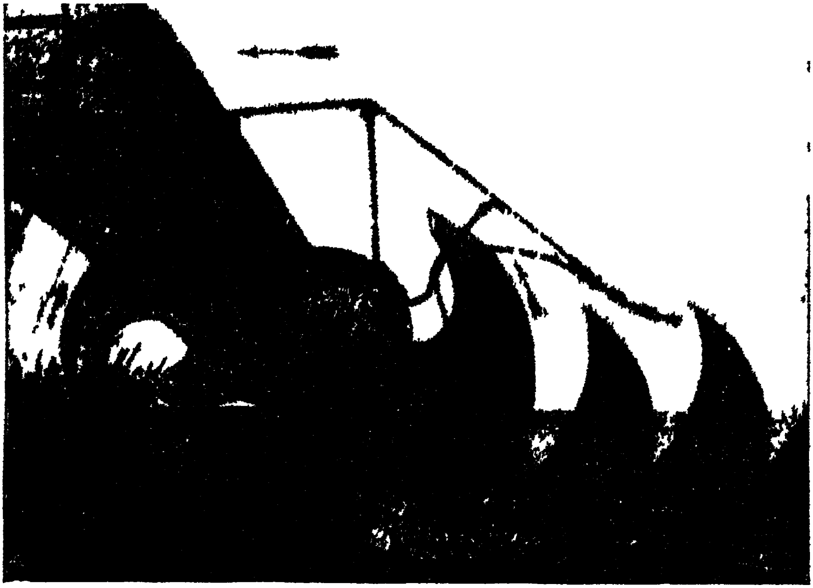


Fig 1. — Section of the MARCIANDI-PORTA rotary digger (one of the flat blades has been removed from the hind spade to show inside the clod of earth at the moment when it touches the screen.

Fig 2 shows diagramatically how the spades work when the tractor advances and the digging mechanism revolves; below is seen the shape and the arrangement of the clods dug up and the numbers indicate the clod turned up by each spade during one complete revolution and also the succession of clods which are, one after another, cut, raised, turned over and thrown down, so to speak, on the bottom of the furrow.

Of course, the convex part of the vertical blades, and consequently the curvature of the blades at right angles, is arranged so that the latter remain constantly, while penetrating the soil, in the groove made by their cutting edge, that is to say they neither compress nor detach the soil, in spite of the forward movement of the tractor.

The same is true for the spade, which is not fixed rigidly on the moving axle, as is seen in Fig. 1, but is placed at the end of an arm fixed to that axle, so that the spade, guided by rollers working in the neck of an eccentric fixed on the frame, accelerates and anticipates the turning over and fall of the clod without interfering with the work of the next spade.

The pace of the tractor and the speed of rotation of the spades must be correlated and governed by the size of the spade. In the machine tested it was ascertained that the spades worked best with clods 40 cm. wide and 18 cm. long ("step" of the spade), that is to say, when the two spades of a pair cut a piece of soil 36 cm. long at each revolution of the digger; so that if the latter makes about 44 revolutions a minute (the normal working pace), the pace of the tractor would be 0.36 metres × 44 = 15.84 metres per minute. With 4 pairs of 40 cm. spades, or a width of 1.60 metres, the machine would consequently dig 15.64 sq m. × 60 × 1.60 = 1500 sq. m. per hour, say, allowing for loss of time in turning, etc, rather more than 1 hectare per day. This new digger proved in trials that it could do perfect cultural work in various kinds of ground-grass land, old ricefield, etc.

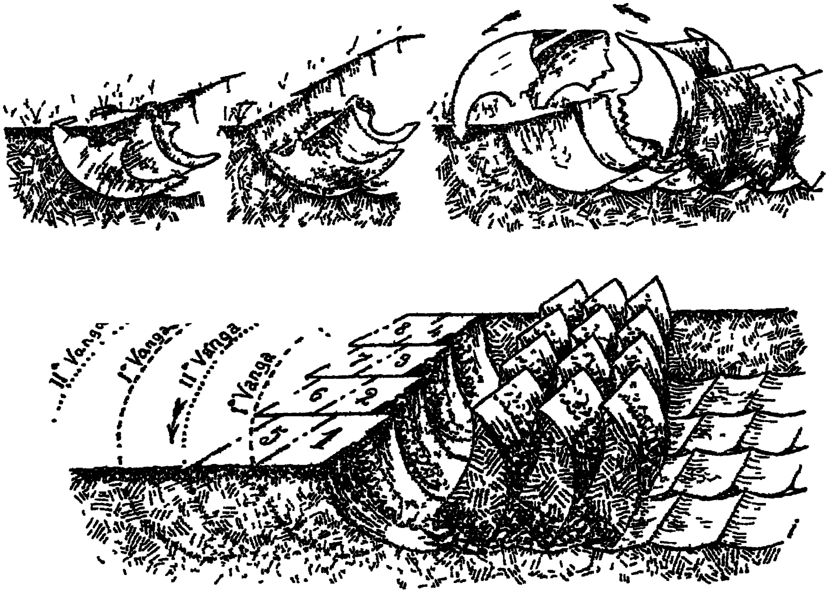


Fig 2 — Sections showing how the spades work *Above*, the process of work of one spade, *below*, the process and effect of work of the 8 spades of the digging mechanism.

The output of this machine is not high, but it could be increased by increasing and enlarging the digging mechanism. It has the advantage of being capable of working to the right or to the left and also of being able to work in the softest and moistest soils, etc.

669 - A Combined Dodder and Plantain Seed Eliminator and Threshing Machine. —

MANRIN G., in the *Journal d'Agriculture pratique*, Year 85, No. 15, pp. 293-294, figs. 1. Paris, Apr. 16, 1921.

Before high-speed threshing machines (which date from 1889) came into use, the cleaning of fodder seeds was done by hand, or, rarely, with a small special machine, the chaff then being passed on to the chaff separator; but, between the two operations it was not noticed that certain weed seeds, such as dodder and plantain, were, so to speak automatically eliminated owing to their shedding their seeds very easily relatively to the shedding of seed by the forage plants.

With highpower threshing machines constructed for forage seeds, effecting consecutively the various steps of cleaning, the weed seeds were not eliminated and it even happened that the machine exercised a disastrous selection by leaving among the seeds of the fodder plants the large seeds of dodder and plantain.

G. DUVAL; 46, Boulevard Gambetta, Saint-Quentin (Aisne), having noticed how easily parasitic plants shed their seeds as compared with forage plants, constructed a machine for eliminating dodder and plantain seeds, in the form of a sieve in the shape of a truncated cone through which he passes the chaff before cleaning it.

DUVAL's machine for eliminating dodder and plantain seeds was then tested by RINGELMANN at the machine testing Station; 12 series of tests were carried out on chaff of various origins (lucernes from the Aisne, white and violet clovers from the Aisne, crimson clover from Vendée, " minette " of the Aisne) and the produce was examined at the seed testing Station. The results were considered excellent. At that time it was a separate machine through which was passed the product furnished by the first thresher; it eliminated all the seeds of parasitic plants and the residue had to be passed on to a second thresher.

DUVAL now presents his dodder and plantain seed eliminator mounted on a high speed threshing machine. The dodder eliminator is placed at the back below the shakers, and receives the produce passed on by the chaff beater, removes the dodder and plantain seed and then feeds the cleaner which is placed below; the latter thus only receives and has to deal with the chaff completely freed from the seeds of dodder and plantain.

According to the construction of the threshing machine, the dodder eliminator may occupy other positions, but it must always be placed immediately in front of the cleaner which it feeds with chaff freed from parasitic seeds.

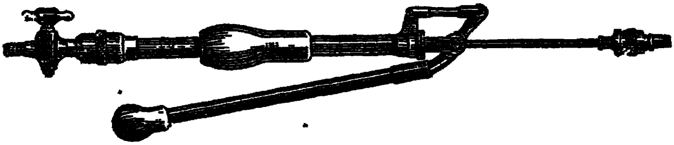
With this system the seed of forage plants furnished by the thresher sells at an enhanced rate which may amount to as much as 15 and 20 % owing to the difficulty that is found in separating dodder and plantain seeds that are mixed with seeds of forage plants, from which only the smallest of these parasitic seeds are eliminated, leaving the larger ones mixed with the seed used by the farmer.

670 - **The "Pax" Sprayer.** — L. D., in *Le Progrès agricole et viticole*, Year 38, No. 20, pp. 477, figs 1. Montpellier, May 15, 1921.

It is well known that with ordinary sprayers, even with the best, too much of the liquid is wasted in spraying bunches of grapes, and it can be understood that, when it is a case of using an expensive solution, such as that of nicotine, there is some hesitation in giving the treatment on the grounds of expense.

The " Pax " sprayer effects a great economy of the liquid. From its powerful jet an excessively fine spray is emitted which envelops the whole grape and is deposited all round it.

The apparatus consists of a tubular brass body (cylinder of the pump), with a wooden handle in the middle; at one end of the body there is the jointed fulcrum of the lever of the pump, at the other end the suction valve with its sieve and the cock to which fits the indiarubber tube connecting the " Pax " sprayer with the receptacle carried on the back of the operator. The pressure is obtained by means of a hollow-stemmed piston moved by the lever. This piston communicates directly with a nozzle fitted with a compression valve.



The " Pax " sprayer.

The apparatus is very simple; all parts are easily got at. Although the spray is emitted under a pressure of 20 atmospheres, almost 10 times that of an ordinary sprayer, the apparatus works very smoothly and the lever can be worked by a woman.

The " Pax " sprayer can be used with receptacles of any kind of sprayer without modification of those receptacles.

AGRICULTURAL INDUSTRIES

671 - **Seed Oil Production in Egypt.** — MILAD, Y. E. (Moâwen, Horticultural Section Ministry of Agriculture), in *The Agricultural Journal of Egypt*, Vol. X, pp. 21-40. Cairo, 1920.

I. COTTON SEED. — The lint of Egyptian cotton seed does not adhere tenaciously to the seed as is the case with American Upland cotton seed or Bombay seed. For this reason it can be stored and transported for long distances without damage caused by heat, and can be crushed and pressed after delinting, without the necessity for reginning or hulling machines.

The author reviews the general distribution of the cotton seed industry throughout the world and states that Egypt exports annually about $^3/_5$ of its cotton seed to Europe, and retains the rest for sowing and for the oil industry. From a calculation made for the 5 pre-war years, 1910 to 1914, the following figures were obtained:

The average annual yield of cotton seed was.	5.217.000	ardebs *
» » export » »	3.571.000	»
Seeds left in the country	1.646.000	»

The seed is pressed in Egypt without decortication.

Details are given of the method of extraction employed. Experiments made in the estimation of oil contents show that neither locality nor variety affects to any great extent the percentage of oil. A number of samples were analysed with the object of ascertaining if there is any difference in the percentage of oil due to local conditions, and this confirmed the above statement. It is worthy of notice that the pink bollworm's attack on the Egyptian cotton has resulted in diminishing the percentage of oil in seed of all varieties. It is also said that the pink bollworm affects the quality of the oil, and this is now under investigation by the Ministry of Agriculture.

The average yield of oil from the cottonseed in present-day markets according to HUGHES, varies from 20 to 24 %.

The most important by-product is the oil cake: the residue after the expression of the oil. This, which as already mentioned, is always taken from undecorticated seed, had the following composition :— Analysis made in 1917. % — moisture 12.86; fibre 22.86; soluble carbohydrates 33.54; proteids 21.08 (containing 3.37 % nitrogen); oil 4.70; ash 4.96. This cotton cake is therefore without doubt a valuable feeding stuff for cattle. The use of the said material as a cattle food or as a fertiliser is not yet practised largely in Egypt; and is worthy of attention on part of the farmer and cattle breeder.

In addition to its culinary uses (1), cottonseed oil is now largely used in the manufacture of soap, both in the crude and refined state, also in the manufacture of candles, glycerine, etc.

FLAX. — The author gives details of the methods of extraction of linseed oil from the seeds of *Linum usitatissimum*. The oil extracted from fresh seed is sticky and turbid; hence, as a rule, seeds are pressed when 2 to 6 months old. Apart from its use as a food, from the industrial point of view it is extensively used in painting on account of its drying properties, and in the manufacture of oil varnishes, printing ink and artifical india-rubber. Boiled linseed oil mixed with powdered cork is employed in making linoleum or floor oil cloth.

Linseed oil cake is used by the Egyptian farmer for feeding milking cows and buffaloes. It has the following composition, which shows that it is very rich in proteids and fat; % — moisture 10.33; fibre 9.42; soluble carbohydrates 35.55; proteids 28.78; fat and oil 8.94; ash 6.98.

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* 1 ardeb = 121 kilos (1 ton = 8.3 ardebs approx.).

(1) See *R.* June 1918, No. 663 and *R.* July 1918, No. 784. (*Ed.*)

[671]

SESAME (*Sesamum indicum*). — Although Egypt used to cultivate large areas of sesame, these areas have decreased gradually with the growth of cotton cultivation and the yearly average is now limited to 7000 *feddâns* (1 *feddân* = 1.03805 acres), which is not sufficient to meet the demands of the native mills.

The methods of extraction are given, and a description of the various uses of this oil. The crop is exclusively used for oil extraction, owing to its richness in oil.

The sesame oil cake has lately been used experimentally as a fuel owing to the coal scarcity, and is said to be equal to coal in heating power. On account of its comparatively high price it is however rarely used for this purpose or for feeding cattle. When unsound seeds are pressed it is unsuitable for this latter purpose.

GROUNDNUT (*Arachis hypogea*). — The average yield per *feddân* is 10 *ardebs* (750 kilos), and, according to the data for 1918, the total area under cultivation was 14 614 feddâns, compared with 11 512 feddâns in 1914. Apart from its use in soap making, it is also utilised in lubricating machinery, holding the second place to olive oil.

SAFFLOWER (*Carthamus tinctorius*). — An annual plant cultivated as a dye and oil-producing crop. It is widely cultivated in Upper Egypt, but less plentifully in lower Egypt, and is often sown only on the edges of fields. It is grown as a catch crop with wheat, barley and lentils in the provinces of Girga and Quena. The seed contains from 30 to 32 % of oil, and in the native presses 1 *ardeb* gives from 50 to 55 *rotls* of oil (1 *rotl* = 0.99049 lb.). The husk forms about 60 % by weight of the seed.

The seeds are pressed in the same way as the linseed, except that the husks are separated by means of sieves after seed crushing. The cake " bokma " is used for feeding cattle and as fuel. The oil dries easily and makes it fit to replace linseed oil in some cases.

Amongst the minor crops grown for oil purposes are mentioned: — lettuce (*Lactuca sativa*), poppy (*Papaver somniferum*), wild mustard (*Sinapis arvensis*) and salgam (*Brassica napus oleifera*), and on a small scale, sunflower (*Helianthus* spp.), castor bean (*Ricinus communis*) and fennel (*Nigella sativa*).

The author gives a brief historical description and the general geographical distribution of the various plants under consideration.

672 - **" Malafu " or " Lagmi," from the Palm in the Belgian Congo and in Southern Tunis.** — I. VAN DERYST, R. P. H., Le vin de palme ou "malafu" in *Bulletin agricole du Congo belge*, Vol. XI, Nos. 3-4, pp. 219-224. Brussels, Sept.-Dec 1920. II. MARCAILHOU D'AYMERIC, M. A. (pharmacien aide-majeur de 1ère classe à Gabès, Tunisie), Analyse d'un vin de palmier ou " laghmi " du Sud Tunisien, in *Journal de Pharmacie et de Chimie*, Year 113, Pt. 7, Vol. XXIII, No. 7, pp. 272-273 Paris, April 1, 1921.

I. — In the Belgian Congo the so-called " malafu " wine is the fermented sap obtainable from certain palms, including *Elaeis*, *Raphia*, *Borassus* etc. indigenous or otherwise. The varieties utilisable for this purpose are fairly abundant and the sugar palm *Arenga saccharifera* stands in the forefront.

The said sap is usually found in large quantities; the composition is variable and of a complex nature but with a high sugar content and that obtained from *Elaeis* contains as much as 80 gm. and more of sugar per litre of sap. This is nearly all transformed into ethyl alcohol at the end of 24 hours, following the spontaneous fermentation process. The fermentation of " malafu " facilitated by the high temperature prevailing in the Congo (average about 25° C) may in all probability be attributed to a variety of *Saccharomyces cerevisiae* Meyen. When at the highest degree of fermentation, " malafu " is in current use amongst the Europeans as a substitute for yeast, in the manufacture of bread. The liquid is whitish, thick, sparkling and has a luscious and a sour taste, slightly alcoholic. When fermentation is complete, the juice contains 4 to 4 ½ % and even as much as 5 to 5 ½ % alcohol and scarcely 1 % sugar. The fixed acid content is found to be nearly always equable, regardless of the degree of fermentation. The total acidity (fixed and volatile acids) is about 48^{m} per litre.

The methods employed to collect the liquid from *Elaeis* are varied: 1) cutting the peduncles of the males; 2) making an incision in the trunk at the base of the males or at the base of a leaf; 3) cutting down a tree and slitting the terminal shoot.

Whatever may be the method adopted, the extraction of the sap is always injurious to the trees and death is the almost inevitable result in the case of *Borassus* and *Raphia*. Other species such as *Elaeis* prove more resistant, but growth is hindered and there is likely to be a diminution in productivity. Often they have remained sterile for several years. Efficacious measures are therefore evidently essential to prevent the natives chopping the palms in order to obtain " malafu," taking into account their high commercial value.

II. " Laghmi " is obtained from the sap of a vigorous growing tree, and when ready for " ponction " as much as 7 to 8 litres per day for more than one month has been collected. When the quantity obtained is considered adequate, the incision is filled with scraps of vegetation and soil; water is given to the palm is considerable quantities and at the end of a year, normal vigour should be regained.

" Laghmi " has the appearance of an opalescent liquid, resembling orgeat syrup and possesses an agreable taste like sweet wine. It may be kept for several months in sealed bottles, but the natives use it up very rapidly, often even before fermentation. After some months, an amylaceous deposit is left, which may be tested with iodine; the acid content is raised and the gum residue is converted into sugar by the powerful acids.

An extract of 100 gm. dried at 100° C gives 10.5 gm. with ash 0.20 gm. containing potash, soda, lime, traces of phosphates, chlorides, traces of iron and manganese.

Average Composition of " Lagmi " as a result of Analyses made by the author at Gabès (Tunisia).

Density	1.0295
Water	82.00 %
Alcohol (after 8 days)	4.50
Total acidity in H_2SO_4	0.70
Volatile acidity (CO_2)	0.22
Glycerine	2.00
Reduction sugars	0.20
Gums	3.00
Mineral substances	7.00

The extract obtained by evaporation of 100 gm. is partially soluble in alcohol. The portion which remains insoluble has the aspect of molasses and apparently consists of sticky and sweet substances. The soluble sticky elements in boiling water are reprecipitated by alcohol and give the characteristic reaction with fragments of iron.

" Laghmi " is therefore a liquid very liable to fermentation but it is chiefly utilised whilst fresh.

673 - **Vinegar from Cereals and the Vinegar Industry in Italy.** — I. MEZZADROLI, G., La fabbricazione dell'aceto dei cereali, in the *Bollettino dell'Associazione Italiana delle Industrie dello Zucchero e dell'Alcool*, Vol XIII, No. 10, pp 137-142. Bologna, Jan. 1921. — II. IDEM, Divagazioni sui fermenti acetici, *Ibid.*, Vol XIII, pts. II, pp. 160-163, Feb., 1921. — III LICITRA, G B., Fabbrichiamo aceto ma di vino, in *L'Italia vinicola ed agraria*, Vol. XI, No 8, pp 117-118. Casale Monferrato, Feb. 20, 1921. — IV. MARESCALCHI, A , *Ibid.*, No 9, pp. 129-130, Feb 27, 1921.

I. II. — Prof. MEZZADROLI has visited a factory at Taverney (Seine-et-Oise, France) where vinegar is made from cereals and he urges Italian manufacturers to try this industry in view of the fact that wine is very dear and that vinegar made from alcohol or other substances lacks fragrance and strength. He is of opinion that the vinegar made at Taverney from rice, maize, millet, etc., is just as good as the best table vinegars; it has a rich aroma and resembles vinegar made from Madeira or Marsala.

The conversion of the cereals or other starchy substances into sugar is effected by *Mucor* No. 5 BOULARD, introduced by BOULARD into Europe from Indo-China, where the Annamites have used it empirically for centuries in making rice vinegar. Each cereal used gives its special aroma; the finest is rice vinegar, followed by maize vinegar and, lastly, vinegars made from millet and cassava.

Process of manufacture. — Steeping for 2 hours at a temperature of 50°-60° C. in an 8 per 1000 solution of hydrochloric acid; cooking for 40 to 60 minutes under pressure of 4 kg. to a concentration of 25 % (that is to say 25 kg. of grain to a volume of 1 hectolitre). The whole is then poured into a fermentation vat (made of iron, and sterilised); cooling of the vat to 40° C.; sowing of spores of *Mucor* No. 5 BOULARD; when the must contains 20 to 40 gm. of sugar per litre the yeast *Mycoderma acetosum* BOULARD (which is an oriental ferment capable of acting at a high temperature) is sown. As soon as alcoholic fermentation is finished (that is to say about 3 or 4 days after the *Mucor* is sown), filtration is carried out in a wooden pressure filter and the liquid is distributed in the acetic fermentation vats. The temperature during this latter fermentation which last for 15 days must be maintained at 25°-28° C.

The dregs are used as food for livestock. Before sale the vinegar is filtered a second time.

The alcoholic yield (per quintal) is from 37 to 38 litres from maize, 43 to 44 litres from rice and much more from cassava. A quintal of maize gives 360-370 litres of " wine " (containing about 10 % of alcohol) ready for acetification. The vinegar contains about 8 % of acetic acid, which is very high. The apparatus required consists of :— Boilers, vats for steeping the maize, rice, millet, etc., one or more iron pots for the cooking, one or more pressure filters, the usual apparatus for acetification, an air compressor for aerating the vats, and a trough for sterilising the air before it passes into the vats.

II. — Dr. G. B. LICITRA thinks that it is much more profitable in Italy to make vinegar from wine than from cereals or any other raw material in view of the fact that wine gone sour is easy to get everywhere at a price less than that of vinegar and that it produces an incomparably better vinegar both as to flavour and food value. To prove how easily a greater production of vinegar would find à market in Italy, he recalls that the pickled eel industry alone uses 300 000 hectolitres of vinegar a year.

As a model factory where wine vinegar is exclusively made, the author describes that of C. BAULINO at Casale Monferrato. The process of manufacture there adopted consists of :— Analysis and pasteurization of the wine; blending; acetification by selected ferments; depuration (left to settle for at least 3 months); filtration. Two kinds of vinegar are produced, the common kind containing 4 % of acetic acid and a fine kind containing 7 %.

IV. — In Italy vinegar is also manufactured from alcohol; in 1920, 6700 hectolitres of anyhdrous alcohol were so treated.

Acetic acid, which is almost entirely of foreign origin, competes closely with the national vinegar industry.

674 - **Experiments Made in the United States on the Dry-Air Sterilisation of Dairy Utensils** (1). — AYERS, S. H. and MODGE, C. S, in *Journal of Dairy Science*, Vol. IV, No 2, pp 79-90, Tables 6 Baltimore, 1921.

The authors, with a view to testing the possibility of applying to the practical dairy-industry the process of sterilising by means of a current of hot air, carried out experiments for the purpose of determining the temperature of the heated air and the length of time required to sterilise (2) milk-cans at farms, and also in places like dairies, where the sterilisation process must be continual.

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(1) See MOAK H., Dry Sterilisation of Dairy Utensils in *Hoards' Dairyman*, 1920, No. 5, pp. 274-288 (*Authors' note*) See also *R.* Nov 1917, No 1074, *R* March 1920, No 364; *R.* Oct. 1920, No 1036. (*Ed*)

(2) Destruction of non spore forming bacteria, of *B. Coli* and of heat resistant lactic bacteria. (*Ed.*)

Taking as a basis the data of preliminary experiments made in the laboratory which showed theoretically that good results seemed likely to be obtained in sterilising dairy utensils, especially since the temperature for the purpose could be kept below that used in the preliminary experiments (1), the authors proceed to sterilise milk-cans.

Three milk-cans of the capacity of 3.8 litres which had contained sour milk, or cream were used. In order not to destroy the bacteria, they were washed in warm water at 45° C. without soda. Two of the cans were then exposed for 15 and 30 minutes respectively to a current of air heated to 110° C. The third can served as a control. Six minutes was necessary to raise the temperature to the required height. In fact, thorough sterilisation could be effected by exposing the milk-cans for 30 minutes to the current of hot air, 15 min. however did not give satisfactory results, as is shown by some figures taken from the table giving the details of the experiment. Thus, the number of bacteria per milk-can rose respectively to 1 400 000 000 — 1 570 000 000 — 3 111 000 000 in the control cans; to 800 — 1500 — 4200 respectively in those heated for 15 minutes, where as in the case of the milk-cans heated for 30 minutes, the number had greatly decreased, being only 200 — 200 — 400 respectively.

While heating in this manner up to 110° C. amply suffices for the sterilisation of all dairy utensils used in farms, it is not enough for continued sterilisation, such as is practised in dairies, or where a large number of milk-cans have to be sterilised in a short time. The authors tried to shorten the duration of the action of the hot air current by raising the temperature in the cans to 120 — 130 — 140° C respectively. The milk-cans, which were of a a capacity of 3.8 litres, were subjected to the same treatment as in the previous experiments.

The best results were obtained by raising the temperature of the milk-cans from 44.4° C. (after washing), to 142.2° C., and by exposing them to this temperature for 2 minutes. Then, the number of bacteria varied between 100 and 700 per milk can.

CONCLUSION. — Sterilisation by means of a current of hot air is applicable to dairy utensils. How to render the process industrially practicable is a question of technique and expense.

675 - Micro-organisms Persisting in Milk after Pasteurisation; their Rôle in the Decomposition of Hydrogen Peroxide. — FOUASSIER, M., in the *Comptes rendus de l'Académie des Sciences*, Vol 171, No 5, pp 327-326. Paris, Aug 2, 1920.

In continuation of his previous researches (2), the author has ascertained that hydrogen peroxide, added after pasteurisation, has an antiseptic action with regard to the lactic ferments which milk picks up during the varying period of time which precedes its consumption. That action is all the more prolonged when the milk is protected from dust bearing

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(1) The absolute thermal death point of all cells (*Ed*)

(2) See *R*, Oct 1920, No 1035 (*Ed*)

B subtilis or *Tyrothrix*, such as is found in cowhouses. The spores of these germs, being resistant to pasteurisation, can consequently grow in the milk, by their catalytic properties they contribute in a large measure to the total decomposition of the hydrogen peroxide, when this antiseptic is used ; moreover, they hasten the development of lactic ferments by providing them with a more easily assimilable element, owing to the peptonnising action which they exert on the albuminoids of milk.

676 – **The Storage and Curing of Mandarin Oranges at the Batangas Commercial Citrus Station, Philippines.** — DE LEON, J., in *The Philippine Agricultural Review*, Vol. XIII, No. 3, pp. 214-216 + diagr. 1, pl. 1. Manila, 1920.

A storage chamber consisting in a vault dug into a hillside, about 6 ft. high and 10 ft. square was made (the diagram shows the plan of the construction, and the plate shows the method of entrance). The purpose of this underground chamber was to secure uniform temperature and moisture conditions. No ventilation was provided.

The fruit from the Batangas Station orchard was harvested on January 31, 1920, and about 1500 oranges of the commonly grown Batangas mandarin variety were placed in this vault.

The result was very successful; the fruits soon assumed a deep orange colour and, the rind became thinner and the flesh less stringy and of better texture ; the flavour of the fruit also was improved. The curing was entirely finished 20 days after placing in the vault, the experiment, however, was continued to determine what length of time such oranges could be held in storage. Data are given of the comparative merits of two kinds of picking, one by clipping the stems of the fruit with shears for that purpose, the other by plucking the fruits from the tree by hand. It appears that there was a larger loss in clipped fruits than in those picked in the ordinary way, and that a slightly larger loss was found in the green than in the ripe fruit, and that size of fruit did not make any difference in its keeping quality.

These results have proved that mandarin oranges may be stored for a longer time than has hitherto been possible, not only without spoiling their flavour and appearance, but actually greatly improving their quality. According to the methods used, 20 days is the longest period that is economically feasible. It is hoped next year, however, by more careful handling, by disinfection of the fruits before storing, and by ventilation of the underground storage chamber, greatly to increase the length of time for storing.

677 – **Cold Storage of Fruits Liable to Deterioration.** (1) — CRUESS, W. V., OVERHOLZER, E. L., and BJARNASON, S. A., in *California Agricultural Station, Bulletin* 324, pp 25-43. Berkeley, Cal., 1920.

The authors rapidly pass in review the previous work of FULTON and DARROW on the methods of preserving small fruits by cold-storage. They then recount the results of their own experiments, in which freshly-gathered cherries, apricots, loganberries, strawberries, blackcurrants, and freshly-prepared grape-juice were subjected to different treatments, before being placed in the cold chamber, and after several months of cold-storage, examined, in order to ascertain their colour, texture, and aroma, and subsequently used in making various products, such as jellies, syrups, tinned fruits, preserved fruits, jams and ices.

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(1) See *R.* Feb. 1921, No. 218. (*Ed.*)

It has been found, that, whereas fruit which is not treated, and is kept at a temperature of about 0° C., loses its flavour, and spoils, after some 3 weeks, the same fruit preserved in water, or syrup, at a temperature varying from —11° to —13° C., retains its flavour and colour for at least 1 month. The best results are obtained by crushing the fruit, with or without the addition of sugar, and keeping it at a temperature of —11° to —13° C. Grape-juice preserved at this temperature is much superior in aroma and flavour to pasteurised grape-juice. The breweries, which on account of prohibition, can no longer make beer, are very well equipped with plant suitable for the cold storage of soft fruits and of fruit-juice.

PLANT DISEASES

GENERAL INFORMATION

678 - **The Organisation and Working of the Italian Phytopathological Service.** — MINISTERO PER L'AGRICOLTURA, DIREZIONE GENERALE DELL'AGRICOLTURA, *Rules for the Application of the Phytopathological Regulations*, pp. 24. Rome, April, 1921.

A brief account of the present organisation of the Italian Phytopathological Service, together with a summary of the directions for the application of the phytopathological regulations issued since 1913, especially in connection with the by-law of March 12, 1916, No. 723 (1).

It contains a specimen of the permit-form necessary for dispatching certain prohibited produce to the interior of the kingdom, and also of the immunity-certificate form for exportation outside Italy.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

679 - **The "Nerume" or "Mal Nero" of the Walnut in Campania, Italy.** — TROTTER, A., in the *Rivista Agraria*, Year XXVI, No. 2, 7 pp. Naples, February, 1921.

On a farm belonging to the Commune of Sant'Anastasia (Province of Naples) there are about 700 walnut-trees which should be in full bearing, but for some years, two-thirds of them have shown signs of withering. The foliage is very scanty, the shoots of the year are short and weak, and the pith is more or less brown; during the summer, the leaves turn yellow, and in June, a larger or smaller number of the small nuts are shed. Finally, the branches become partially or wholly withered, and when the course of the disease is very rapid, the whole tree succumbs. From cracks or lesions in the trunks, there exudes, especially in spring, a blackish, somewhat mucilaginous substance, which frequently comes out from small bubble-like cavities in the heart of the tissues. These are, however, often not very noticeable, but an unfailing symptom of the disease is the more or less distinct blackening of the living tissues situated immediately beneath the cortex, which also extends irregularly to some extent up the trunk. As a rule, only the base of the trunk and the large roots are thus attacked, the lower branches remaining immune.

The whole root system, as well as the larger roots, are infected to a certain degree, and crystalline deposits are often found in large numbers in the tissues. On the thick roots especially as far up as the root-collar, or even higher, are seen masses of whitish mycelia or thin black rhizomorphous filaments which wind among the tissues, or make their way between the wood and the cortex. The white mycelia sometimes assume arborescent forms, which are very characteristic, being arranged in a fan-like manner. Sometimes the mycelium causes the de-lignification of the large roots, which become quite soft.

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(1) Cf. INTERNATIONAL INSTITUT OF AGRIC., *Annuaire international de législation agricole*, Year VI (1916), pp. 876-887. Rome, 1917. (*Ed.*)

A cursory investigation reveals the fact that the soil on which these walnut-trees are growing varies in depth, but is everywhere shallow, and further, rests upon a very compact bed of rocks which, from their nature cannot easily be penetrated by the roots, and contain but few elements suitable for plant food. It is thus permissible to suppose that the roots of the walnut-trees, when the latter have reached a certain age, do not only meet with an obstacle preventing their further expansion, but are also unable to abstract from the soil all those substances which are necessary to the life of the tree. Further, it is well-known that walnuts need rich deep soil, and therefore do badly where the soil is poor and shallow. All these circumstances contribute to lower the activity of the root-system, and predispose it to the attacks of the cryptogamic flora of the soil, which derive great benefit from the humidity resulting from the impermeability of the sub-soil. Hence the constant presence of large numbers of mycelial hyphae which can be seen from out side, lie hidden under the cortex, or wind concealed from sight through the various tissues of the cortical and ligneous zones. Another fact of a general nature must also not be lost sight of, viz., the climatic conditions. In Campania, rain falls frequently and heavily from October to March, so that the ground is constantly moist; if to this fact is added the relatively warm temperature of this region which prevents the soil freezing, even during the coldest months, it is easily understood, that the cryptogamic soil flora has every opportunity of growing with extreme rapidity, and of attacking the roots during their winter rest and, moreover, when they are already weakened by complex conditions of a cultural nature.

It is advisable to scarify the infected wood, and to disinfect the lesions, but this is not enough to control a disease which originated and has its chief extension, in the root system. Therefore, unless it is decided not to take any measures, seeing that the soil is probably quite unsuited to the cultivation of walnuts, the only thing to be done is to use substances to destroy the fungi in the soil and prevent their growth. This would at all events give a certain respite to the roots, so that the length of the life of the tree would be prolonged and a fairly good crop of walnuts secured for a few years. Carbon bisulphide could be injected to a depth of 40-50 cm., 30-35 gm. being used per square metre; other suitable substances are a 2.5—3 % solution of sulphate of iron, a 5 % solution of sulphate of copper (the roots having been properly uncovered), or quicklime.

These remedies must be applied at two different seasons, quicklime, carbon bisulphide or copper sulphate being used in the winter from November to December, and sulphate of iron sprays in the spring, soon after the leaves have unfolded.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

680 - **Biology of *Puccinia graminis* f. sp. *Tritici* in the United States.** — See No. 611 of this *Review*.

681 - **"Vuiteboeuf" and "Bretonnières". — Wheat Varieties in the Swiss Jura, Resistant to Rust.** — See No. 617 of this *Review*.

682 - **"Calabacillo" Cocoa Variety Resistant to Disease in Dominica, West Indies.** — See No. 596 of this *Review*.

683 - **On the Use of Coloured Screens in the Control of the Cryptogamic Diseases of Plants.** — LANCE, R., in the *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. CLXXII, No. 19, p. 1201. Paris, May 9, 1921.

Blue and violet rays have been used successfully in the medical treatment of certain human skin diseases.

They can also be employed in practically the same manner in the control of cryptogamic diseases of plants, especially of the vine, by forming on the surface of the leaves, stems, flowers and fruits, a coloured screen through which the blue, violet and ultra-violet rays pass.

In order to obtain such a screen, a very light coloured mixture is sprayed in fine drops upon the surface of the parts of the plant that are to be protected. This support is made by mixing in water a substance such as sulphate of lime, lime, kaolin, talc, etc., upon which are fixed, by means of freshly-precipitated alumina, bluish-green, blue, indigo, or violet dyes, (especially ultra-marines) which are innocuous to plants.

The following compound is especially suitable:

Ultramarine	blue	650 gm.
»	green	250 »
»	violet	100 »

This is mixed in several litres of water, then 2 kg. of sulphate of lime and from 1350 to 1400 gm. of powdered quicklime are added.

When the mass is uniformly coloured, the colouring matters are fixed on the screen by incorporating with it 1 kg. of sulphate of aluminium, or 1.500 kg. of alum.

The lime decomposes the sulphate of aluminium or alum, liberating alumina which fixes the colouring matter upon the support and at the same time makes it adhere better to the plant.

When the reaction is finished, the volume of the water is made up to 400 litres, and the spraying is carried out with any of the ordinary types of apparatus.

684 - **Fungicidal Zinc Mixture.** — LANCE, C., in the *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. CLXXII, No. 19, pp. 1201-1202. Paris, May 9, 1921.

Both zinc chloride and sulphate are employed as antiseptics in medicine.

Certain products containing zinc can also be used with great advantage as fungicides and vehicles for pigments, so as to form coloured screens to be used in the control of cryptogamic plant-diseases.

Under these conditions, the antiseptic action of zinc is added to the toxic effect of the blue, violet, and ultra-violet rays.

In order to prepare this zinc mixture, 1 kg. of zinc sulphate is dissolved in 100 litres of water, 500 gm. of powdered lime being added to precipitate the zinc in the form of the hydroxide, and subsequently decompose all the aluminium salt used as a fixative; then in the mass thus obtained are incorporated 80 to 100 gm. of the colouring matter. When this has been done, 250 gm. of sulphate of aluminium, or 375 gm. of alum are added and the mixture is very vigorously stirred for a quarter of an hour. Then, after filtering it is ready for use.

685 - **The "Pax" Sprayer.** — See No. 670 of this *Review*.

686 - ***Sclerospora philippinensis*** **n. sp., a Peronospora Injurious to Maize and Other Gramineae in the Philippines.** — WESTON, W. H JR., in *Journal of Agricultural Research*, Vol. XIX, No. 3, pp. 97-122, figs. 3, 12 pl. Washington, D. C., 1920.

A very serious fungal disease recorded for the first time in 1916, and briefly described in 1918, attacks maize in the Philippines. It is of common occurrence in the islands of Mindanao (Cotobato Valley), Cebu, Negros, and Luzón (Provinces of Batangas, Laguna, Rizal, Cavite, Bulacan, Tarlac, Pampanga, Nueva Ecija, Pangasinan, Ilocos Norte, La Unione and Isabela), and appears to have existed for over ten years in some of these localities.

The injuries wrought by this malady known as the Downy Mildew of maize are extremely serious. Under favourable conditions, the fungus is able to destroy entire fields, and in some districts, the natives have been obliged to give up growing maize. Further, the losses cannot be lessened in any way by using the diseased plants for forage, for cattle appear to dislike it greatly, and will only eat the forage, if it contains a large proportion of healthy maize.

As a rule, the disease manifests itself by the appearance of more or less extensive yellowish streaks on the leaves accompanied by the formation of a white downy covering, especially on the parts which have become chlorotic; by the abnormal growth of the vegetative portions of the plant, and by the imperfect development of the ear, which becomes partially or completely sterile. The change in colour is the first and most striking symptom, while the presence of the downy investment affords the most certain index of the disease. The effects of the latter may show themselves from the moment of the development of the third or fourth leaf, to the formation and ripening of the tassel and ear.

Maize is the only crop that is attacked in the open field by this parasite. The disease has however also been found to attack, though to a less extent, *Euchlaena luxurians* and *Andropogon Sorghum* in the experiment plots of the College of Agriculture belonging to the Philippine University. Hybrids resulting from crossing maize with *E. luxurians* are equally susceptible to the malady. Inoculation experiments carried out on numerous other Gramineae have given negative results.

The pathogenetic agent is a peronospora belonging to the genus *Sclerospora*. It appears new to science, and has been described by the author under the name of *Scl. philippinensis* n. sp. This fungus is characterised by the predominance of its conidial stage, the absence of oospore, at least so far as is known at present, and by its conidia invariably giving rise to hyphae on germination. In the latter respect *Scl. philippinensis* differs from the typical variety *Scl. graminicola* (Sacc.) Schroet, which is distinguished by its short conidial stage, the predominance of its oospores, and the zoospores resulting from the germination of its so-called conidia (zoosporangia). *Scl. philippinensis* presents striking analogies to the following species which have recently been described and attack all varieties of maize: *Scl. javanica* Palm. (in Java), *Scl. Maydis* (Rac.) Butl. (in the British Isles), and *Scl. Sacchari* T. Miy (in Formosa, Queensland and Fiji).

Maize is usually attacked by this parasite while its seedlings are very young, the mature plants generally escape. By the time the symptoms manifest themselves, however, the mycelium of *Scl. philippinensis* has already invaded the tissues of its host to a large extent. The mycelium may be found in nearly every part of the plant, with the exception of the radicle system; it is most abundant in the cells of the vascular of the sheath and in the mesophyll. The conidiophores which unite to form the above-mentioned downy covering, are produced in large numbers by the fungus, but only during the night when the surface of the leaves is covered with dew or rain-water. The thickness and persistence of this covering of moisture greatly influence the size and growth of the conidiophores. The conidia, which also vary much in dimensions and shape, germinate rapidly (if they are fresh), in water, and in different cultural media at temperatures ranging from 6.5° C., to 25° C., always giving rise to hyphae ; when they are dry, they lose their germinating power, hence their diffusion and the infection of new plants nearly always take place before dawn. In spite of all the researches that have been made, it has not yet been discovered whether *Scl. philippinensis* produces any oospores, or other resting bodies. The fungus appears to spread by passing from one plant to another. A *Sclerospora* of which, so far, only the oospore stage has been found occurs on *Saccharum spontaneum* L., a very common wild graminea growing in the Philippines. It remains to be determined whether this fungus is connected with the species (*Scl. philippinensis*), of which the conidial stage grows on maize.

687 - ***Peronospora Hyoscyami*** **Injurious to Tobacco in Florida, and Georgia.** — SMITH. E. F., and Mc KENNEY, R. E B, in *United States Department of Agriculture, Department Circular*, 174, 6 pp. Washington, D C., April 1921.

At the request of the tobacco-planters in Florida, the seed-beds growing near Quincy were inspected on March 29, 1921. They were found to be seriously attacked by a fungal disease (mildew) which appeared to have nothing in common with the other tobacco diseases previously reported in the Malaysia and Australia.

The disease in question made its appearance almost at the same time' about March 1, in four widely separated seed-beds in Gadsden County (Florida). It generally started at one end, and then spread over the rest of the bed, in some cases by direct enlargement of the infected spot, and in others through the development of other infected patches. In most cases, the entire bed became diseased within a week from the first appearance of the parasite. By April 5 the mildew had already spread to at least twenty-six seed-beds in the county of Gadsden; on April 8, it was reported from many places in the adjoining county of Decatur (Georgia)

The disease seems to be caused by *Peronospora Hyoscyami*, originally described by DE BARY as found on *Hyoscyamus niger* in Europe. It appears never to have attacked tobacco in Europe, but has for many years done great injury to that plant in Australia (New South Wales and Victoria). It has also been reported in South Africa. In 1855, it was observed in South California on *Nicotiana glauca*, a plant that was introduced into that country from Argentina. The disease must also exist in Texas, for in the mycological collections of the United States Department of Agriculture, there are young tobacco plants gathered in 1906 at Halletsville, which are attacked by a Peronospora that is considered identical with that recently found in Florida.

It is not known how the disease was introduced into Florida, but it is improbable that the few seeds imported into that country conveyed the infection. Very likely, however, it found its way into the United States by means of the second-hand mats used for packing the tobacco which comes from Sumatra. On the other hand, the pest may have reached Florida by way of California and Texas, especially if this species produces no oospores, and is the same as that found on *N. glauca* in California, in which case, the disease may have been directly imported through the medium of the débris accumulated on the shores of the S. Atlantic or of the Gulf of Mexico, since the examination of the United States National Herbarium has shown that *N. glauca* has been collected at New Jersey (1897), at Quarantine Station in South Carolina (1889), and on several occasions at Pensacola in Florida (1880, 1897, 1903, etc.).

The rapid spread of the disease in the two countries is easily explained. The fungus produces a large number of dry, powdery very light conidia, and further, the atmospheric conditions were most favourable to its diffusion Observation has shown, beyond any manner of doubt, that the parasite has been in many cases carried from one seed-bed to another by the agency of visitors, who transport on their boots, or clothing, the conidia of the parasite from infected to healthy beds. The diffusion of the fungus in the same seed-bed is certainly attributable to a large extent, to the action of wind, and perhaps the latter contributes in some measure to its spreading from one bed of tobacco to another.

It is at present impossible to predict the further course of the malady in the United States; probably henceforth the tobacco-grower will find the fungus a very dangerous pest, and the only way in which he will be able to obtain a good crop, will be to employ all the means at his disposal for combating this new enemy, such as sowing in sterilised soil, using seed of undoubted purity, and observing hygienic rules in the treatment of seedlings, so that the disease cannot be introduced from other seed-beds into his own.

Seeing that the climate of Florida is very damp, and that the method of culture adopted there in growing the fine wrapper tobacco (shading the fields with laths and cloths), increases the moisture of the surroundings, and given the fact that freshly introduced diseases do greater injury in a new country than in the land where they originated, prudence would recommend that young plants (however healthy in appearance), grown from infected seed should not be cultivated in these shaded fields in Florida. Further, entrance into immune seed-beds should be denied to persons coming from infected plantations.

As soon as the presence of the disease was known, the destruction of the small number of badly infected beds was advised. It was also recommended to spray all healthy, or slightly attacked, plantations with a dilute solution of Bordeaux mixture, which contrary to what had been observed in Australia, appears to have given good results in Florida. The best results are certainly obtained by spraying late in the afternoon, when the leaves of the young tobacco plants show a tendency to assume an erect position; this allows of the remedy reaching more quickly the lower surface of the leaf which is the most likely seat of the infection.

688 – ***Pleospora infectoria*** **var.** ***aucubicola*** **n. var., an Ascomycete Injurious to** ***Aucuba japonica*** **in Italy.** — MONTEMARTINI, L., in the *Rivista di Patologia vegetale* Nos 3-4, pp 33-35 Pavia, April 1, 1921

During the last year, the upper and external leaves of two specimens of *Aucuba japonica* with variegated foliage, which are growing at Montubeccaria (Province of Pavia) have presented a blackened and scorched appearance, as if they had been burnt. The first sign of disease is the occurrence of black patches; these are nearly always situated at the tip of the leaf, although sometimes they are also to be found on the edges, The patches are at first clearly marked off by a line from the rest of the leaf. but later on extend over the whole lamina which withers, curls up and finally dies.

The new leaves that grow to replace those that have withered and fallen, are speedily attacked in the same manner. The disease appears and spreads in winter and summer alike.

The mesophyll of the blackened leaf is invaded by a brown septate mycelium; numerous short hyphae passing to the exterior of the felt-like surface of the older part, where they produce a large number of the short conidial chains characteristic of an *Alternaria*. Subsequently, on the same surface, there appear small papillae, which are perithecia resembling those of *Pleospora* and containing ascospores with five transverse septa. In artificial cultures, these ascospores have always produced an *Alternaria*.

These perithecia, from their general characters and the olive-green of the ascospores, must be attributed to *Pl. infectoria*, further, the shape, size and colour of the *Alternaria* (*Alt. tenuis* Nees) representing the conidial stage, point to the conclusion that we have here to do with a variety of *Pl. infectoria* Fuck.

As the fungus in question was certainly parasitic upon a plant which hitherto it had not attacked, the author is of opinion that it should be regarded as a distinct variety, and has given it the name of *aucubicola* (*Pl. infectoria* Fuck. var. *aucubicola* n. var.).

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

689 - **Destructive Insects Recently Observed in California.** — Essig, E. O., in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. IX, No. 4, pp 140-143, figs. 3. Sacramento, California, April, 1921.

The Mexican bean-weevil (*Spermophagus pectoralis* Sharp), was found infesting beans at San Francisco in 1915, and again in 1920 (December). The insect appears to have been imported.

The barnacle scale (*Ceroplastes cirripediformis* Comstock), had hitherto only been taken in greenhouses in various parts of California, but in 1920, two specimens were collected in a citrus orchard, where however the species was rare.

The Spanish scale-insect (*Chrysomphalus dictyospermi* Morgan), has been found on several occasions on ornamental plants in greenhouses in California, chiefly on *Kentia* spp. The author recently observed it completely killing some young avocado trees (*Persea gratissima*), in a greenhouse at Berkeley.

A small nitidulid beetle (*Carpophilus dimidiatus* Fabr.), has often been taken on soured and decaying fruit in Southern California. The adults are usually found in the flowers of *Opuntia* spp., but had not been considered of any special economic importance, until large shipments of shelled pea-nuts arriving at San Francisco from Java were found to be seriously injured by the beetle.

Other insects taken on the same lots of shelled pea-nuts were the caudelle (*Tenebroides mauritanicus* Linn.), the red flour-beetle (*Tribolium castaneum* Herbst.), the sawtoothed grain-beetle (*Silvanus surinamensis* Linn.), and the Indian meal-moth (*Plodia interpunctella* Hübn.).

Dried copra and copra products imported to San Francisco were found to be seriously damaged by the cigarette beetle (*Lasioderma serricorne* Fabr.). On the same products, *Silvanus surinamensis*, *T. castaneum*, and the red-legged ham-beetle (*Necrobia rufipes*) were also observed.

690 - ***Pectinophora (Gelechia) gossypiella*** **as a Cause of Diminution in Cotton Seed Oil Percentage.** — See No. 671 of this *Review*.

691 - **Effect of Spraying on Composition of Oranges.** — See No. 609 of this *Review*.

692 - **The Importation and Acclimatisation in Uruguay of *Aphelinus mali*, a Hymenopteron Parasitic Upon the Woolly Aphis *(Eriosoma lanigera)* of the Apple Tree.** — Sundberg, R., and Trujillo Peluffo, A., in the *República oriental del Uruguay, Ministerio de Industrias, Defensa Agricola, Boletin mensual*, Year II, No. 3, pp 65-81, figs 14. Montevideo, March, 1921.

With a view to testing the efficacy of the chalcid hymenopteron *Aphelinus mali* in controlling the woolly aphis of the apple-tree (*Eriosoma*

[*Schizoneura*] *lanigera*), the " Defensa Agricola " of Uruguay obtained from the United States Bureau of Entomology some colonies of this aphis which were attacked by its endophagous parasite; they arrived at Montévidéo on January 13, 1920. The material was at once sent to Sayago, and pieces of branches of apple-tree bearing the infected colonies were attached to the branches of young apple-trees that had been severely attacked by *Er. lanigera*, special cages being placed over them.

These apple-trees were first examined in February in order to ascertain the results of the experiment. On February 15, and still more on the succeeding days, the increasing numbers of the adult hymenopteron and of aphids that had evidently been attacked by the parasite proved that *A. mali* was developing and spreading.

The results being so far successful, measures were taken to propagate the hymenopteron by using larger apple trees (which were also enclosed in cages) of different species and growing in the open in various places. The results were eminently satisfactory. Apple-trees to which colonies of the aphis had been attached were examined on March 16, and it was found that the endophagous parasite had obtained a firm footing.

The authors give a description of the genus *Aphelinus*, a short account of *A. mali* and some information regarding the life-history and habits of the latter, based upon the observations and experiments made out of doors and in the laboratory in Uruguay.

As the acclimatisation of *A. mali* in the territory of the Republic has now been ascertained, the « Defensa Agricola » has turned its attention to increasing systematically the propagation centres of this insect which, there is every reason to hope, will prove of great assistance to apple-growing.

693 - A New Preparation of Copper Aceto-Arsenite (ParisGreen) and Its Practical Advantages in the Control of the Animal Pests of Plants. — ESCHERICH, K., in the *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No. 15, pp. 104-105. Berlin, February 23, 1921.

The use of Paris Green (copper aceto-arsenite) in the form of powder presents various difficulties. In order to obviate these, the insecticide has been recently placed on the market in Germany in tablets, each about the size of a tablet of chocolate, and containing sufficient of the compound to make a hectolitre of spraying-mixture. Each tablet is divided by grooves into five smaller divisions, one of which is enough to make twenty litres of the mixture for spraying. Each of these smaller divisions is, in its turn, subdivided transversely, into equal parts, one of which is sufficient for preparing 10 litres of spray. In this manner, the weighing of the substance, an operation entailing loss of time and of material, is completely dispensed with.

Further, the neutralising agent has been incorporated into the tablets, so that the troublesome business of adding lime is wholly unnecessary.

Another and more important practical advantage possessed by the new preparation is its considerably increased power of suspension, as compared with " Uraniagrün " (the name usually given in Germany to aceto-arsenite of copper in powder form)

The experiments made by the authors have proved the new preparation to be entirely satisfactory in every respect.

694 - **The Control of *Euproctis chrysorrhoea*, a Macrolepidopteron Injurious to Fruit Trees and Forest Trees in Orléanais, France, during 1920.** — URSAT, J. and GAUMONT, L, , in the *Comptes rendus de l'Academie d'Agriculture de France*, Vol VI, p 23, No 581-583 Paris, 1920.

In 1919, *Euproctis chrysorrhoea* increased in numbers to such an extent in the Department of Loiret, that in the spring of 1920, the fruit-trees and forest trees of Orléanais were covered with the nests of this insect.

Hence it was imperative to take energetic measures for the destruction of the caterpillars. In the first place, the Prefect issued two decrees obliging all owners of estates to destroy before March 15, any nests of *E. chrysorrhoea* that existed on their property.

Subsequently, the Departmental Agricultural Office not only circulated popular leaflets, but also decided to give the sum of 30 000 fr. in prizes for nests collected by the school-children, who were awarded a prize of 10 fr. for every 1000 nests collected from fruit-trees, and 5 fr. for the same number taken from the hedges

A certain number of school-masters, and officials at the mayoralties undertook, under the control of the delegates of the Departmental Agricultural Office, to count and destroy the nests and distribute the prizes. The Office gave them a bonus of five francs per 1000 nests received.

A total of 2 183 179 nests was thus obtained, but a much larger number was, however, destroyed by the horticulturists and Railway Companies of the region on their own account.

The total sum distributed in the form of prizes was 33 389 93 fr.

695 - ***Dryopeia hirsuta* n. sp., An Aphis Injurious to Rice in the Philippine Islands.** — BAKER, A C , in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol X, No. 4, pp 159-160, figs 3 Sacramento, California, April 1921

A morphological description of a new species of aphis, *Dryopeia hirsuta*, of which specimens were collected several times in 1919 at Los Baños (Philippines), where the insect lives upon the roots of rice and does considerable damage to the crop.

This species is closely related to *Dr. bella* Kock.

696 - **An Undetermined Mite Injurious to the Potato in India.** — MANN, H H , NAGPURKAR, S D , and KULKARNI, G S , in *The Agricultural Journal of India*, Vol XV, Part 3, pp. 282-288, pl. 2. Calcutta, 1920.

In the district of Poona, where the potato is much more cultivated than in any other part of Western India, the plants grown during the rainy season in 1917, were found to be seriously attacked by a peculiar disease which, on account of the reddish colour assumed by infected fields, was known among agriculturists under the name of " tambera." In years when this malady was particularly prevalent, the yield was so low, that the grower hardly obtained as many potatoes as he had used for seed.

The symptoms of the disease are as follows: at all stages of the plant's growth, but generally a month after it has sprouted, patches, of a slightly blackish colour and somewhat oily-looking, make their appearance on the lower surface of the leaves especially on the young foliage. These patches subsequently become red, spreading and increasing with great rapidity, and finally assume a bronze tint. The upper leaves acquire a bunched-up appearance, the edges become wrinkled, and the leaf-hairs are very prominent. Gradually, all the leaves wither, beginning with those at the top of the stem; the main stock however still remains green for some time, but finally also loses its colour, and withers. The plant tries to react by sending out a series of auxiliary shoots, which lose no time in being attacked themselves, and end by withering. All this takes place within thirteen or fifteen days. The disease usually manifests itself after the tubers are formed, and when they are about the size of a walnut. The tubers develop no further, and hence the crop is very light, and consists of very small potatoes. At the beginning, only a few plants are attacked, but the disease extends in patches, with the greatest rapidity, so that the whole field is soon infected.

Recent researches have shown, that the disease is not confined to the Poona potato area but is also found in other districts, and even in Sind. Further, it has been discovered that it also attacks the winter potato crops, but in the last case, it gives rise to little apprehension, and may even escape notice.

All attempts made to discover the immediate cause of the malady had proved ineffectual, until in 1919, the attention of the authors was attracted by the description of a very similar disease which had been noticed in 1917, in Hawaii, and was attributed by CARPENTER to a mite probably belonging to the family *Tetranychidae* (1). The investigators then turned their attention to looking for this parasite, and soon discovered countless numbers of a minute mite, which in all its characters resembled that found in the Hawaii Islands, in all the diseased portions of the potato-plants, and especially on the lower surface of the leaves.

The authors, however, did not consider that the undoubted presence of this mite was sufficient to prove that it was the cause of the disease. They therefore carried out many experiments, both in the laboratory and the open field, upon healthy potatoes, shoots and even only leaves attacked by the mite, and taken from diseased plants. The results, which were quickly obtained, were invariably and clearly positive.

Excellent results were obtained in the control of the pest by spraying infected plants growing in pots, or in the open, with lime-sulphur, or dusting with dry sulphur; the former remedy however proved less efficacious than the latter. The treatment was applied three times: when the plants were three weeks old, when they were nearly six weeks old, and finally after they had been planted between two and three months. The difference between the sprayed and the unsprayed fields in their neighbourhood was very noticeable. As the use of sprays is new to the cultivators, it is probable, that the dry sulphur treatment, though less efficacious, will be the remedy most commonly applied, at least for the present.

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(1) See *R* Nov. 1918, No 1314 (*Fd*)

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All the varieties of potato that are usually grown are quickly attacked by the mite, if the conditions are favourable. The English variety " Epicure " seemed, from the result of experiments, to be endowed with a certain amount of resistance, but in order to be sure of this fact, further researches are necessary.

As regards the propagation of the mite from one year to another, it would appear, judging from the conditions of the zones where the present investigations were carried out, that the disease may be spread by the potato plant itself. Indeed, although there are in that zone two quite separate crops—the rainy season potato crop (" kharif "), and the winter one (" rabi "), which grow at regular intervals, nevertheless the seasons are not clearly distinct, and practically, potato-growing continues without interruption from the June of one year to the following March. The " kharif " crop is sown in June and July, and lifted in September and October, sometimes even as late as November. The " rabi " potatoes are planted from November to March ; so that this very late crop is harvested at the time the " kharif " potatoes are planted. Scattered plants growing from tubers remaining in the soil from the preceding crop are also to be found in the fields. Thus, there are always potatoes growing in the research zone, and although the winter crop is not seriously attacked by the parasite, it is however not entirely immune. The low temperature prevents much injury being done and so little attention is paid to the matter. The mite renews its destructive work at the return of the hot season, in April or May, and is probably spread by means of the cultural operations carried out at this time in the fields of " kharif " potatoes, although it is quite possible, that it has other plant hosts. A mite, recognised as identical with that living on the potato, has been found on *Cyamopsis psoraloides* at Baroda, Padra, Surat and Poona. Potato plants infested with the mite attacking *C. psoraloides* soon manifested the characteristic symptoms. Experiments were also made on the capsicum and tomato, but these remained quite immune. It is, however, very advisable, that further experiments and investigations should be undertaken in connection with this subject.

697 - ***Cacoecia franciscana*, a Microlepidopteron Injurious to Apples in California.** — PENNY, D. D., in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. X, No. 4, pp. 146-150 + 3 figs. Sacramento, California, April, 1921.

In the Pajaro Valley, in the Watsonville district (California), apples at picking time, and while stored during the winter, have of recent years, been subject to the attacks of the larvae of the small tortricid moth (*Cacoecia franciscana* Wals). This article gives the description of the different stages of the insect, and also a short account of its life-history.

The damage done by the caterpillar consists in a peeling of the skin of the apple, involving little loss of the pulp. The area affected may be small, or extensive, it is usually well-defined, and has a clear-cut, sculptured appearance. The apples may be attacked on the side, but the larvae usually injure the cavities of the calyx and peduncle.

Two other lepidoptera closely associated with *C. franciscana*, *Pandemis pyrusana* Kearf, and *Peronea* sp., have been observed in the Watsonville district, and their larvae. superficially resemble the caterpillars of the former insect, though the adult forms are quite distinct.

698 - ***Phloeosinus* sp., a Beetle Injurious to the Cypress in Mexico.** — RIQUELME INDA, J., in the *Memorias y Revista de la Sociedad Cientifica "Antonio Alzate,"* Volume XXXVIII, Nos. 11-12, pp. 401-405, 2 figs. Mexico, F. D., Jan. 1921.

Some of the many cypress-trees of the " La Hormiga " Farm situated on the edge of the Chapultepec forest were found to be infested in 1918, as they had been already in 1909, by a beetle belonging to the genus *Phloeosinus*. This coleopteron is iron-grey in colour, cylindrical and about 1 mm., or 1 ½ mm. in length. It excavates galleries between the bark and the wood of the tree that act as host. Some of the cypresses seemed to have already succumbed to its attacks.

There is some reason for believing that there is only one annual generation of this insect in the Federal District of Mexico.

In order to hinder the spread of this pest, it was advised to fell the dead cypresses without delay, and to remove the bark and burn it on the spot. All the bare surfaces of the trunks were also to be cauterised. Those trees which the beetle has only just begun to attack (they can be recognised by the fact that the upper branches are usually first affected), can be saved if these branches are removed and burnt on the spot. Should the injury begin at the end of the trunk, the tree must be cut down and burnt; the wound should at once be covered with the cement used in grafting.

It may be added that all the branches and fragments of old wood lying about on the ground ought to collected and burnt. These different operations are best executed in winter.

INJURIOUS VERTEBRATES

699 - **Injury Caused By the Rodent, *Hypodeus glareolus* to the White Fir in Switzerland.** — HUNZIKER, W., in the *Schweizerische Zeitschrift für Forstwesen*, Year LXXII, No. 4, pp. 97-100, figs. 1. Berne, Apr. 1921.

It had already been observed that, in some parts of the Canton of Aargau and also in other Cantons of Switzerland, the young white firs had lost the top of their terminal shoots. This damage had been in turn attributed to squirrels, cross-bills, jays and, in some cases, to roe-deer. Of late years, however, it has been observed to occur especially frequently in the woods belonging to the Canton and Communes in the neighbourhood of Murgenthal, Oftringen, and Rothrist. Very many young white firs are seen that have lost the tip of their terminal shoots. As a rule, such trees put forth several lateral branches that take the place, to some extent, of the principal shoot whose development has been arrested, and this causes a deformation of the tree which later reduces the amount of saleable timber.

The injuries noticed in the above-mentioned woods were quite typical. In trees 50 centimetres high, and even in taller specimens that were six or eight metres high, the terminal shoot had been severed at the tip by a clean slanting cut with every appearance of having been made with a knife Careful investigation, however, revealed the fact that, in the case of many firs, the extremities of lateral shoots had been removed while in others the buds alone were absent.

Occasionally at long intervals, shoots that had been partly severed, but otherwise uninjured still hung to the branches, while others lay yet beneath the trees; this shows that the marauder usually carried off his prey. In very rare instances, these shoots were seen to have been partially gnawed, which proves that the damage could not be attributed to birds, but must be the work of rodents

Observations made in 1919 in the woods belonging to the Canton of Lenzburg, where the same damage had been wrought, showed that the mischief had been done at night. Further, the ground beneath the first that had been attacked was perforated with numerous holes and galleries made by the rodents, and shoots cut in different ways were even found within them.

These facts pointed to *Hypodeus glareolus* Wagn. as the culprit responsible for the injuries to the white fir, for this animals is an excellent climber.

The truth of this supposition was proved at last in February and March, 1920, at Murgenthal where, by the help of clever stratagems, not only were several of these rodents caught beneath a group of white firs that had been severely injured in the above-mentioned manner, but some of the little animals were surprised and caught on the trees when in the very act of devouring the buds. It has further been found that *Hyp. glareolus*, when in captivity, readily eats not only seeds, fruit, and meat, but also shoots of the fir.

It is only a few years ago (1911) that *Hyp. glareolus* was said to be rather rare in the Canton of Aargau. Now, however, it is by no means unknown in the vicinity of Murgenthal. It is also found in granaries, where it is often caught. Perhaps the destruction of the foxes has had something to do with the unusual increase of these small rodents.

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ALFREDO RUGGERI, *gerente responsabile.*

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FIRST PART

ORIGINAL ARTICLES

Organisation of Agricultural Book-Keeping in Norway

Office for Research on Farming Conditions of the " Det. Kgl. Selskap for Norges Vel " (Royal Society for the Welfare of Norway).

By M. KROSBY
General Secretary.

In 1907, H FIVE, then Professor of Agriculture, later Agricultural Councillor, collected infomation on farming conditions in several districts in the east of Norway (See *Tidsskrift for det norske Landbruk* [Review of Norwegian Agriculture], 1909, p. 21 *et seq*)

In 1910, H FIVE, obtained a scholarship awarded by the "Society for the Welfare of Norway" for the purpose of studying research methods relating to economic conditions of agriculture in Germany and Switzerland

In the *Review of Norwegian Agriculture* for 1910, p. 315 *et seq*, he gave an account of the manner in which it was proposed to carry out this work in Norway, as the " Society for the Welfare of Norway " had decided to take up the question, and, in 1911, established a Research Office regarding farming conditions

Two main objects were proposd :—

1) To work so that complete well ordered accounts might be kept generally by farmers.

2) To collate the results of the accounts of various types of agricultural properties in different parts of the country, to elaborate them, and to endeavour, as far as possible, to make them useful to practical and theoretical agriculture

1) Since 1915, the work done with the object of generalising book-keeping has consisted chiefly in giving annual courses of instruction in book-keeping for agricultural officials. These officials, in turn, hold courses of instruction for the farmers in the districts. In this way it is hoped that, with the help of these local courses, every farmer who wishes to keep accounts of his farm may be given instruction. The number of farmers who have received instruction in this way from 1915 to 1920 was as follows:—

In 1915	1126	In 1918	209
1116	1148	» 1919	481
1917	516	» 1920	about 1250

The considerable decrease in the number during the years 1917-1919 was due to the fact that, during these critical years, it was difficult, both for teachers and farmers to find time for accounts.

The Research Office tries to help progress in book-keeping by selling accounting requisites direct to the farmers.

2) Researches relating to the farm itself are based on an intimate collaboration between the Office and the farmers who have signified their willingness to participate in such work by giving information regarding the economic situation in agriculture. The Office makes use of a special system of book-keeping which is explained in detail in H. FIVE's book entitled *Veiledning i landbruksregnskap* (Text-book of Agricultural Book-keeping). The accounts year runs from April 1 to March 31.

The farmers who have agreed to participate in the researches are instructed by means of a short course, in the system and the work they have to do. The farmers are specially asked to make daily entries. All work of abstracting and checking is done by the Office, which, at the time the first balance sheet is made out, helps to determine the more difficult entries; moreover, the book-keeping is controlled for a certain time after accounts have been opened. By distributing the work in this way. the work and time required from each particular farmer is restricted,

It is quite understood that such an organisation of book-keeping is necessary when results of accounts are to be obtained from *small agricultural holdings*. It is chiefly in such cases that knowledge of the manner in which the work should be done is lacking and that there is the smallest amount of time available for keeping accounts. This has great importance in Norway, where the properties in most cases are *small agricultural holdings*.

Besides making out a complete balance sheet as on April 1st, the farmers who co-operate in this work keep a combined cash-book and day-book (called "cash day book") arranged according to the "system of headings." The Office advises them to enter the totals of the entries in one place, the cash entries under the heading "Cash", and the credit entries under the heading "Total" before the heading "Cash", and to refer it to the Office to constitute a partial double-account. Most of the farmers take advantage of this offer, which makes it easier to keep the book.

The farm labour employed, the work done by the farm horses, as well as the land under various crops and their yields are entered on special forms.

In the accounts a distinction is made between "*professional use*" and "*used for consumption*." Professional use is subdivided into:— *a*) Farming strictly speaking, including the production of crops and the upkeep of farm animals; *b*) the forest; *c*) subsidiary business, or business outside *a*) and *b*). Used for consumption is divided into:— *a*) Domestic economy; *b*) private consumption. It is chiefly information concerning professional use called farm, that was desired and which has been most completely elaborated. On special printed returns the transactions are subdivided and the more important entries are carried forward separately both as gross and net totals under receipts and expenditure; the latter are called *net* receipts and *net* expenditure of the farm (1).

The number of accounts worked out each year has been:

For the	1st	accounts	year	(1911-1912)	39	accounts
›	2nd			(1912-1913)	42	»
›	3rd	›	›	(1913-1914)	73	›
›	4th	›	›	(1914-1915)	82	»
›	5th	»	»	(1915-1916)	110	›
›	6th	›	›	(1916-1917)	101	›
›	7th	›	›	(1917-1918)	92	›
›	8th	›	›	(1918-1919)	102	›
›	9th	›	›	(1919-1920) . . .	about 100	»

For the year 1920-1921, the number will be greater, several participators having been inscribed commencing from April 1, 1920. The farmers who take part have not to bear directly the cost of these researches. Instruction, material, publications and the work of working out the balance sheets are provided gratis; in return the Office reserves the right (guaranteeing discretion) of publishing such of the results of the researches as may be of public interest.

The disturbing influence of the war on the level of prices and the excessive increase in prices which occurred during the war years have made research work relating to farming conditions of the last few years extremely difficult. As has been noted in the last reports, it is, in these circumstances, very difficult, not to say impossible to judge correctly the results of the different years from an accounting standpoint. It is impossible to avoid variations in the reports between the results of accounts of different agricultural properties and of different districts, variations which are not caused in an entirely objective manner.

In order to make the best possible comparison of the different accounting years, the attempt was made to prevent, as far as possible, the super-values from figuring directly in the balance sheet. Thus, no super-value has been entered for the land, buildings, machinery, etc., except when there has been corresponding expenditure in the way of improvement.

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(1) See on this subject:— H. Five, "Results of book-keeping on agricultural properties in Norway" No. 7, for the year April 1, 1914-March 31, 1915. (*Ed.*)

3) Besides the work undertaken with the two objects above mentioned, the Office has, since 1916, annually collected information regarding increase of wages for the more important kinds of wages in agriculture. In 1916 and 1920 information was also collected regarding hours of work, their number, distribution, etc. The publication of this information has so far consisted only in annual provisional abstracts relating to wages, as it has not yet been possible to publish detailed information.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

700 - **The Agricultural Development of Brazil in the "Message" of H. E. Epitacio Pessoa, Addressed to the National Congress at the Opening of the XI^th Legislature.** — Rio de Janeiro, May 3, 1921.

The message addressed by the President of the United States of Brazil, EPITACIO PESSOA, to the National Congress on the occasion of the opening of the XIth legislature may be defined as a complete review of all work in progress and a truly dynamic programme of further undertakings. The problem of agriculture is also fully considered.

After dealing with the important question of emigration and the creation of new centres of colonisation to which the Government of the Republic is devoting every effort, the President dealt with the work of the Department of Agriculture.

The following is a short statement of the more interesting points:—

AGRICULTURAL COLLEGE. — The College of Agriculture and Veterinary Medicine was re-organised by Decree No. 14120 of March 29, 1920. A course of industrial chemistry has been added, so that the College now includes 3 classes of higher study:— Farm engineering, veterinary medicine, and industrial chemistry.

A demonstration field for experiments, which will be visited by the fourth-year agricultural student, has been established at Deodoro and placed at the disposal of the College.

BIOLOGICAL INSTITUTE OF AGRICULTURAL DEFENCE (See *R.*, April 1921, No. 442).

GENERAL AGRICULTURAL EXPERIMENTAL STATIONS. — The first agricultural experimental Stations were created by Decree No. 8319 of October 20, 1910. The work of the General Station deserves special mention, especially as regards the selection of the sugar cane and the remedies against *Tomaspis parana* Distant, one of the worst pests of citrus plantations.

AGRICULTURAL APPRENTICESHIPS. — These receive and keep out of the way of vice thousands of young people under age, who are employed on work in the fields and whose future professional work is thus prepared for.

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The number of these apprenticeships, which are subsidised by the State, increases constantly and their good effect becomes increasingly manifest.

SERVICE OF AGRICULTURAL INSPECTION AND PROPAGANDA. — This Service specially looks after the organisation relating to the preparation of an agricultural map, an indispensable guide for the exploration and thorough evaluation of soils. The Service has already divided each State into physiographical zones according to conditions of soil, climate and altitude, and the extent and distribution of cultivation. These data will be registered and completed after examination of the geological returns.

The propaganda Service also encourages the use of fertilisers, of which in 1920, it distributed 30 000 metric tons; this is, however, a very small quantity in view of crops which require much greater amounts, such as coffee and sugar cane. In 1920, 601 tons of good seeds were distributed among farmers and they were supplied with 35 226 fruit tree plants.

Regarding control of plant diseases, 4131 cases of formicides, 10 cases ses of carbon bisulphide and 2697 kg. of various insecticides were distributed.

EXPERIMENTAL STATION FOR THE CULTIVATION OF CEREALS. — Recent investigations have shown that Brazil could produce all the wheat required for local consumption. In the States of Rio Grande do Sul, Parana, Santa Catharina, there are great areas where the conditions of soil and climate are admirably suitable for wheat growing.

In addition to the arrangements already made for increasing the production of wheat, the Brazilian Government has instituted an Experimental Station for the cultivation of cereals at Alfredo Chaves (Rio Grande do Sul). The land placed at the disposal of the Institute covers 75 hectares and has been suitably divided into plots and pieces for genealogical selection and multiplication of selected types

Although work was not commenced until July, 1920, it has been possible to make some temporary nurseries, sown in accordance with all the rules of the art, which will help very much the initial selection of the parent plants, to be used afterwards in the work of genealogical selection. The seed has been brought from Uruguay, France and Czechoslovakia and comprises 33 varieties of wheat, 6 of barley, 11 of oats and 2 of rye. Two similar Stations have been organised for the States of Santa Catharina and Parana.

SEED SERVICE. — Decree No. 14 825, of August 24, 1920, created a Seed Service charged with the multiplication and selection of seeds, experiments of adaptation and acclimatisation, genetic researches on the use of good seed.

Fields for production of and experiments on, selected seeds have already been organised at the Stations of Deodoro, Rezende and S. Simão. The first produces 400 hectolitres of maize and 37 hl. of rice ; the second 600 hl. of maize and 2 000 hl. of rice ; the third 900 hl. of maize and 255 hl. of rice.

The results obtained prove that it is desirable to constitute new fields suitably distributed all over the country in accordance with the commercial conditions and the environmental conditions of the different zones.

COMMERCIAL CLASSIFICATION OF AGRICULTURAL PRODUCE. — The necessity of establishing, as has already been done in the case of coffee, a commercial classification of certain agricultural produce for which there is a large trade, such as rubber, cotton, cereals, textile fibres, cocoa and tobacco, is now recognised, as ungraded products placed on a foreign market are always valued below their real worth.

The Government is already taking an interest in the solution of this important question.

COTTON SERVICE. — The Cotton Service, created by Decree No. 1417 of March 27, 1919, has at length, after a period of preparation, been able to commence its work and the utility of this new Service is becoming more clearly marked. At a time when a lack of raw material is felt in the manufacturing centres of the whole world, Brazil naturally takes a keen interest in the production of an article so much in request (1). Experimental Stations and testing fields have been instituted for the improvement, selection, and propagation of the best varieties, for the study and improvement of local varieties, for the control of diseases of cotton, etc.

By means of enquiries and statements made in the different States it has been possible to identify diseases of cotton, some of which are quite new to Brazil Among those previously known may be mentioned *Pectinophora* (*Gelechia*) *gossypiella* and *Alabama argillacea*, which cause damage which is estimated, in some cases, to amount to 80 and 90 %. To prevent the introduction of foreign parasites, a Service of supervision and control is required; agencies for this have already been constituted in some of the cotton-producing States.

The results obtained in the States of Sergipe and Parahyba for the control of *Pectinophora gossypiella* are most encouraging; their example will also be followed by the other States. To complete the work the Federal Government will send out and distribute all necessary instructions to the competent authorities and agencies so as to regulate control and make it more efficient.

The Cotton Service has carried out a series of investigations relating to the sterilisation of seeds and to the pernicious effects of too high temperature in insufficiently ventilated store houses. At present 2 co-operative fields are being organised in the State of Maranhão, 3 in Piauhy, 2 in Rio Grande do Norte, 5 in Parahyba, 4 in Pernambouc, 1 in Alagoas, 4 in Sergipe, 2 in Bahia, and 1 in Minas Geraes.

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(1) Regarding the possible development of cotton cultivation in Brazil, see the very interesting Report made to the Brazilian Minister for Foreign Affairs by Dr Deoclecio DE CAMPOS, Commercial Attache to the Brazilian Embassy at Rome and Delegate for Brazil at the International Institute of Agriculture (*Boletim do Ministerio des Relações Exteriores*, No 16. Rio Janeiro, Oct 1920) (*Ed*)

District Officers will distribute selected seeds, carbon bisulphide, and other disinfectants with all necessary instructions; they will establish control and quarantine for seeds intended for plantations or for export.

Experimental fields are being prepared at the two Experimental Stations of Maranhão and Parahyba; they are intended for the selection of indigenous plants, for fixing the positive characters of those plants and for the acclimatisation of exotic varieties.

A collection of samples of all kinds of Brazilian cottons is being made for the purpose of an Exhibition and a commercial classification of this product is also being worked out.

The Federal Government has made numerous regulations relating to customs and fiscal matters, control against fraud and abuses, with the object of encouraging and increasing the protection afforded to cotton cultivation in the Republic.

VEGETABLE OILS. — When the immense area of the coastal zone, still largely uncultivated, is considered and if the fact that Brazil grows a very large number of oil palms is also remembered, the enormous wealth which might be derived from the cultivation of these palms invites thought.

The most important palm is the coconut, which elsewhere does not produce fruit until the 8th year, whereas in the climate of Brazil it begins to produce from the 4th year, especially when it is grown close to the sea. Next in importance comes the " babassu " palm which grows chiefly in the States of Piauhy and Maranhão. Exports of the produce of this palm have reached, in less than 10 years, the value of about 13 million *milreis*.

The " tucum " and " macahubeira " palms may also be mentioned and there are other palms, little grown at present but which may give good results later on.

FRUIT-GROWING STATION OF DEODORO. — Experimental fields at this Station were brought under cultivation in 1920 for the seed Service, vine growing, tobacco, the Biological Institute of Agricultural Defense and the Agricultural College.

The Station has sent out 13 209 orange and 444 mango grafts. The Experimental Station of Patagones (Argentina) has sent this Station a collection of various European and Asiatic fruits and the material for study is constantly being added to.

There are two special sections for the cultivation of the vine and of tobacco.

Experimental researches concerning the registration and study of the best exotic varieties of vine as well as the selection and multiplication of varieties already acclimatised, have been undertaken at the Station. It will soon be possible to dispose of materials that will enable each region to be supplied according to its special conditions of soil and climate. Special arrangements have been made to expedite the control of phylloxera and diseases of the vine.

The nursery contains 30 000 vine stocks of 52 of the best varieties.

In addition to the introduction of exotic varieties of tobacco, the

Station is also working on the improvement of indigenous varieties by selection and hybridisation,

SERICULTURE. — An Experimental Station for Sericulture. has been instituted at Barbacena, with the object of organising an important movement in favour of this branch of production.

MOTOR CULTIVATION. — Owing to the scarcity of labour, the Government recommends and facilitates in every way the general use of mechanical ploughing. Regarding the purchase of agricultural machinery generally, of selected seeds, insecticides and fungicides, the Government provides the farmers with these articles at cost price.

LIVE STOCK AND BREEDING. — By means of special credits the Government helps and facilitates the importation of well-bred animals for breeding purposes; a large number of first class animals has thus been distributed to Zootechnical Institutes, in accordance with the environmental requirements of the different States.

In 1920, the Zootechnical Institute of Pinheiro sold 44 bulls (of which 36 were bred by the Institute), 11 donkey stallions, 214 boars, and 22 rams.

The Zootechnical Institute of Lages and the Experimental Demonstration Estates in Santa Marca and Ponta show similar activity and have developed similarly.

To facilitate State work, a suitable subdivision of work of a technical and fiscal character has been provided for the Service of inspection of meat and its derivatives, the cattle trade, milk and its derivatives, protection against disease, etc.

Work and researches with the object of obtaining immunity against babesiosis are strenuously carried out; experiments have been made on 239 animals (of which 122 belong to the State) and only 7 (2.95 %) died under treatment. Important centres of epizootic disease have been removed and the infected regions in the States of Minas Geraes and Rio Janeiro have been reduced to very small areas Owing to the recent re-organisation of the Directorship General of Zootechnology, the Government will in future be quickly informed of cattle disease, so that such prophylactic or therapeutic measures as may be necessary can be at once applied.

HYGIENE AND PUBLIC HEALTH. -- The Federal Government, in co-operation with the different States of the Republic, is organising in a most up- to-date manner the Services which have for object the isolation and extinction of epidemic foci. Thus isolation hospitals and sanatoria for tuberculosis, leprosy and venereal diseases have been instituted. The Oswaldo Crus Institute merits special mention in connection with the study of tropical diseases; yellow fever is almost extinct.

In rural centres the work of prophylaxis and treatment was amalgamated and centralised by means of agreements between the Governments of Minas Geraes, Maranhão, Parana, Pernambuco, Para, Parahyba, Rio Grande del Norte, Rio de Janeiro, Alagoas, Bahia and Matto Grosso.

Decree No. 3987 of January 2, 1920, has attached the Institute of Serotherapy to the Oswaldo Crus Institute as the technical section for the culture, preparation and supply of vaccines and for the organisation of the sanitary Services relating thereto.

During the first quarter of 1920 the Institute has furnished the Health Department with 183 000 tubes of vaccines.

701 - **Spontaneous Sulphuretted Hydrogen Fermentation: Effect on Seeds of Leguminosae and Digestive Troubles Caused by Poisoned Flour.**— See No. 706 of this *Review*.

CROPS AND CULTIVATION

702 - **The Influence of Temperature and Rainfall on the Yields of Certain Kinds of Wheat at Svalöf and Ultuna, Sweden. — Recent Development of the Organisation of the Service of Agricultural Meteorology in Sweden.** — WALLÉN, A., in *Geografiska Annaler*, Year 1920, Part. IV, pp. 332-357. Stockholm, 1920.

Results of a series of observations on the course of meteorological factors, the growth, and yield in grain and straw of Sammetsvete, Bore and Grenadier wheats at the two Stations of Svalöf and Ultuna.

Sammetsvete (Svenskt Sammetsvete) is a selected indigenous Swedish wheat (Svenskt Landvete); it is noted for its great resistance to winter cold, which enables it to give satisfactory crops even under very severe climatic conditions. It is also very early but it has the defects of weak straw and poor resistance to rust.

" *Bore* " *wheat* (Borevete) originated from English wheat cultivated at Svalöf. Though not so resistant as the indigenous wheat to the rigours of winter, it is, however, sufficiently so, as to permit its flourishing in those regions of Sweden that are south of Mälar. Its straw is strong, it ripens late and has poor resistance to rust.

" *Grenadier* " *wheat* is a selection from the English wheat " Shiriff ". In strength of straw and date of ripening it does not differ from " Bore " wheat which it resembles also in its susceptibility to rust: it stands cold badly and suffers from it even in the most southern districts (Scania).

Statistical data regarding the production of grain and straw are available for the following periods:— *Sammetsvete* 1890-1917 (at Svalöf), 1897-1917 (at Ultuna); *Bore* 1896-1917 (at Svalöf), 1897-1917 (at Ultuna); *Grenadier* 1895-1915 (at Svalöf).

Regarding meteorological figures, temperatures and rainfall have been registered from one month of August to another; the data have been taken from the records of the meteorological Observatory of Lund, the nearest to Svalöf, and the records made at that station have been used for Ultuna.

TEMPERATURE AND YIELD IN GRAIN. — If the coefficient of correlation between the yield in grain and the temperatures of different periods is calculated, it appears that, for a good harvest, low temperature in autumn and high temperatures during the rest of the growing season are required.

The negative correlation between the autumn temperatures and the harvest (September and October) becomes positive at Ultuna (+ 0.34 for Sammet and + 0.26 for Bore), whilst at Svalöf the negative values are always rather high (— 0.37 for Sammet, —0.41 for Bore, and —0.30 for Grenadier). This different behaviour is explained by the fact that sowing is much later in the north than in the southern districts and that September and October temperatures are required to ensure good growth of the young plants before winter. On the other hand no such need is felt in Scania where the temperatures are always high. In August the coefficients are always negative both at Svalöf (—0.27 for Sammet) and Ultuna (—0.36 for Sammet and —0.21 for Bore), and the same is the case for the months of November and December (Bore and Grenadier wheats with positive coefficients. but very low ones, constitute exceptions at Svalöf). It is not easy to explain the negative correlation between the autumn temperatures and the harvest. NILSSON-EHLE, in his work entitled " Good and bad years for wheat in Scania ", asserts that excessive heat during the first stages of growth induces luxuriant growth which predisposes the plant to the attacks of *Leptosphaeria herpotrichoides* and to lodging.

In the months of January and February there are positive coefficients which are sometimes very high :— At Svalöf, for Sammetsvete and February temperatures + 0.33 ; for Bore + 0.51 ; at Ultuna, + 0.17 for Sammetsvete and + 0.49 for Bore. These data also show the greater resistance of Sammetsvete to low temperature. The temperature of the months March and April, when winter passes into spring, is very important for the growth of the plants as can be seen from the positive values, sometimes very high, of the coefficient of correlation, especially at Svalöf.

At Svalöf :— April temperature and yield in grain of Bore wheat, $r = + 0.49$; of Grenadier wheat, + 0.17 ; March temperature and yield of Sammet wheat, + 0.28.

At Ultuna the coefficients are lower : — March and Bore, + 0.30 ; March and Sammet, + 0.20.

High temperatures in winter and spring are therefore very generally favourable to grain ; the coefficients of correlation do not, however, enable the different eventual behaviours of each variety to be determined.

For the months of May and June the coefficients of correlation are nearly all positive, especially for Bore (+ 0.66) and Grenadier (+ 0.62) at Svalöf At Ultuna the coefficient for Bore is negative

The most important period is, according to NILSSON-EHLE, that which follows immediately after the flowering stage, at the end of June or the beginning of July ; high temperatures at that period would have a very favourable effect. But that point does not seem to have received any certain confirmation from the present series of observations ; the coefficients of correlation between the yield and the July temperature are low and often of contrary signs. Thus Bore gives $r = + 0.32$, while Sammet gives, for the period 1896-1917, $r = —0.16$.

Perhaps higher correlations relating to shorter periods might be given, relative to each stage of vegetation ; but for that phenological information is lacking.

RAINFALL AND HARVESTS. — The influence of rainfall on the yield in grain appears through a series of rather low coefficients. However, for the Bore and Grenadier varieties, if reference is made to the rainfall of October at Svalöf, positive coefficients worth noting are found (+ 0.27 and +0.41 respectively), while for Sammet the coefficient is negative, though very low. For Sammet and Bore the correlations are positive with January and negative with April and May; the latter result agrees with NILSSON-EHLE's opinion that wheat does not mind a dry spring on good soils, but is rather injured by rain and excessive moisture in spring and the beginning of summer, which tend to lodging and the development of disease (*Puccinia glumarum* and *Leptosphaeria herpotrichoides*).

At Ultuna, the phenomena appear in a slightly different form; a high negative coefficient for December rains (Sammet —0.54 and Bore —0.55). This is perhaps due to snow lying on soil not yet frozen.

For January, there are positive coefficients as at Svalöf; then, contrary to what happened at Svalöf, positive coefficients also in May; it appears therefore that a dry spring is felt more at Ultuna than at Svalöf.

To sum up:—

1) For a good yield of grain at Svalöf low temperatures from August to November are required; at Ultuna, however, that cold period should be broken by high temperatures in September and October.

2) High temperatures in winter and spring give positive results in both places.

3) At Svalöf, rainfall in November and December has no noticeable influence on the harvest, whereas at Ultuna it is decidedly injurious.

4) Abundant rainfall in spring and summer is rather injurious at Svalöf and very favourable at Ultuna.

Regarding the behaviour of each variety, it has only been possible to define it very slightly. At Svalöf:—

1) Heavy rainfall in October would suit Bore and Grenadier, but would be detrimental to Sammet.

2) High winter temperatures have a much more marked positive effect on Bore than on Sammet (the same is true at Ultuna).

3) Grenadier stands rain and excessive moisture in spring much better than Bore and Sammet.

However, the results of these researches are insufficient to enable accurate indications of the character and behaviour of each variety to be formulated: data relating to the most important stages of the vegetative period, with the help of which the relationship between the plant and its environment would be more clearly indicated, are completely wanting.

Hence the necessity of observations on the growth of the plant in open fields and the course of meteorological factors It is with that object that the author has begun in Sweden, with the cooperation of the "Sveriges Allmänna Lantbrukssallskap" and on the lines indicated by Prof. AZZI, to collect bio-meteorological observations relating to each variety of the more important species of cereals, helped in this work by farmers and agronomists.

The information collected at the Central Office of Meteorology and Hydrography is afterwards completed by the addition of those meteorological data which are most important for the growth of plants.

The following forms are so used for autumn wheat in Sweden:—

Autumn report for the commune of . .
Province of . . . . Owner

1) Kind of wheat:. . . . .
2) Line: . . . .
3) Area sown: . . . .
4) Quantity of seed: . . . .
5) Quality of seed: . . . .
6) Date of sowing: . . . .
7) Method of sowing: . . . .
8) State whether the sowing was early or late and give reasons: . . . .
9) Kind of Soil: . . . .
10) Drainage: . . . .
11) Previous crop: . . . .
12) Physical properties of the soil: . . . .
13) Manuring : . . . .
14) Moisture of the soil at the time of sowing: . . . .
15) Favourable and unfavourable conditions at sowing:. . . . .
16) Date on which the young seedlings appeared: . . . .
17) State whether the birth was advanced or late and what were the presumed causes
18) Conditions favourable or unfavourable to germination: . . . .
19) Growth of the wheat: . . . .
20) Remarks: . . . .

Winter report. Commune of . . . . .
Province of . . . . Owner

1) Kind of wheat: . . . .
2) Line: . . . .
3) Information regarding snow during winter (depth of snow, uncovered places, etc.):
4) Information regarding frosts during winter (date of freezing of the soil and date of thawing: depth to which frost penetrated the soil; etc.): . . . .
5) Data relating to the crust of ice: . . . .
6) Stagnation of water from thawing: . . . .
7) Date when tillering commenced: . . . .
8) Whether late or early and what were the presumed causes: . . . .
9) Conditions which were favourable or unfavourable to the wintering of the wheat: .
10) Remarks: . . . .

Summer report. Commune of . . . . . .
Province of . . . . Owner

1) Kind of wheat: . . . .
2) Line: . . . .
3) Surface dressings given in spring: . . . .
4) Date of formation of ears: . . . .
5) Whether early or late and causes: . . . .
6) Conditions which have been favourable to formation of ears:

7) Moisture of the soil before and after formation of ears: . . . .
8) Frosts from the time of renewal of growth up to formation of ears: . . . .
9) Date of flowering . . . .
10) State whether it was early or late and give reasons: . . . .
11) Conditions which have been favourable or unfavourable to growth during the period comprised between the formation of ears and flowering: . . . .
12) Frosts during that period: . . . .
13) Date of ripening: . . . .
14) State whether it was early or late and give reasons: . . . .
15) Conditions which have been favourable or unfavourable during the period comprised between flowering and ripening: . . . .
16) Frosts during that period: . . . .
17) Remarks: . . . .

Report on the harvest in the Commune of . . . .
Province of . . . . Owner . . . .

1) Kind of wheat: . . . .
2) Line . . . .
3) Date of reaping . . . .
4) State whether it was early or late and give reasons . . . .
5) Conditions which were favourable or unfavourable to reaping . . . .
6) Frosts during the period comprised between ripening and harvesting: . . . .
7) Yield in grain per hectare, kg. . . . .
8) Yield in straw per hectare, kg. . . . .
9) Quality of the grain (kg. per hectolitre): . . . .
10) Remarks: . . . .

In this way the Central Office will collect all data required for replies to the questions contained in Prof. Azzi's international forms and these forms will be filled up for Sweden at the Central Office of Meteorology and Hydrography at Stockholm. The whole of this work must facilitate the study of problems in agricultural meteorology, help in solving them and contribute to the development of the new science, agricultural ecology.

703 - **Study of the Bacterial Flora of the Soil.**— I Bargagli-Petrucci, G., in the *Atti della R. Accademia dei Georgofili*, Year CLVIII, Vol. XVIII, Part I, Scientific section pp. 37-46. Florence, Jan. 1921 — II Meeting of March 13, 1921. *Ibid.*, Historic and official portion, pp XVII-XVIII.

I. — At the Third Congress of the "Società italiana per il progresso delle Scienze", in 1913, the Section of Botany passed and presented to the general meeting the following resolutions:—

"The Congress, considering that the bacterial flora of the soil has a most important influence on both wild and cultivated vegetation by the changes and the chemical and physical action which it is able to produce and exercise; considering also that the bacterial flora may vary profoundly under the influence of the geographical, geological climatic, physical and chemical conditions of the soil, expresses the desire that a systematic and accurate study of the bacterial flora of the various soils in different regions of Italy and of the Italian Colonies shall be undertaken, in the interests of science and of national and colonial agriculture."

Referring to this resolution, the author explains briefly, with examples, the importance of the bacterial flora of the soil and of its geographical distribution. He remarks that the whole civilised world abounds at the present time in astronomical, meteorological, geodynamical observatories, etc, which make their observations in a systematic manner while keeping close and constant relations with each other, the first with the object of compiling, by means of well-organised collaboration, the map of the heavens, the second for registering the rainfall or the wind, the third for analysing the movements of the earth's crust; work so organised becomes infinitely more useful than the greatest effort that one of these institutions could accomplish alone. Why should not the same be done in the domain of microbiology?

The problem might be stated practically in the following way:—

1) To study and establish relatively simple and practical methods which will enable indications to be furnished regarding the different biochemical forces in soils (nitrifying, denitrifying, ammonifying, oxidising or reducing).

2) To examine, by means of these methods, the largest number of soils in the most diverse conditions, taking care to keep an exact account of these conditions.

3) To sum up and co-ordinate the data collected so as to draw from them general conclusions and practical rules that may be of use to agriculture.

The first and the last parts should be entrusted to an Institute of to a Laboratory which would fulfill the functions of a central office (and it is by the creation of such an organisation that a commencement should be made), which would decide the methods to be adopted, formulate the most important questions to be solved and then collate the data collected so as to draw from them suitable conclusions. The second part should be entrusted to the greatest possible number of institutions and even of individual specialists, who would undertake to carry out the researches indicated, by means of the methods adopted and with scrupulous precision.

II. — In the discussion which took place on the subject of BARGAGLI-PETRUCCI's paper the President expressed the desire that the International Institute of Agriculture might help in the realisation of the proposed programme and the meeting ended by the nomination of a Committee to study the question thoroughly.

704 - **The Manurial Value of Carbon Dioxide.** — I. BORNEMANN, F, Kohlensäure and Pflanzenwachstum, in *Biedermann's Zentralblatt*, Year 49, No. 12, pp. 451-460. Leipzig, Dec., 1920. — II. FISCHER, H, Neuere Erfolge der Kohlensäuredüngen, in *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, Year 35, No. 20, p. 275. Berlin, May, 1920. — III. CLAASSEN, H. Begasung der Pflanzen mit Kohlensäure, in *Chemiker Zeitung*, Year 44, Nos. 95 and 130. Cöthen, Aug. and Oct. 1920. — IV. RIPPEL, A., Kohlensäure und Pflanzen, in *Fuhlings Landwirtschaftliche Zeitung*, Year 70, Nos. 1 and 2, pp. 7-11. Stuttgart, Jan. 1921. — V. RIEDEL, F., Die Aussichten des Kohlensäuredüngeverfahrens mit Hilfe von Abgasen, in *Chemiker Zeitung*, Year 45, No. 20, pp. 157-158. Cöthen, Feb. 15, 1921. — VI. BORNEMANN F., Kohlensäure und Pflanzenwachstum, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 35, No 51, pp 693-695. Berlin, Dec. 18, 1920. — VII. IDEM, Die Kohlenstoff Ernährung der Kulturpflanzen,

in *Fuhling's Landwirtschafliche Zeitung*, Nos. 1-2, pp. 1-7. Stuttgart, Jan. 1921. — VIII. IDEM, Zur Kohlenstoffernährung der Kulturpflanzen, in *Deutsche Landwirtschaftliche Presse*, Year 48, No. 25, p. 191. Berlin, March 30, 1921. — IX. LEMMERMANN, O., Ueber die Kohlensäureernährung der Pflanzen, in *Mitteilungen der D. L. G.*, Year 36, No. 51, pp. 696-699. — X. GERLACH, Die Kohlensäureernährung der Pflanzen und der Stalldünger, in *Mitteilungen der D. L. G.*, Year 36, No. 9, pp. 147-250. Berlin, Feb. 26, 1921.

I. CARBON DIOXIDE AND PLANT GROWTH. — BORNEMANN states that the weight of the crop depends very much on the production of carbon-dioxide (CO_2) in the soil. and that market-garden crops only get their carbonic food by assimilation of CO_2 produced in the ground through the leaves and not from CO_2 present in the air, in the average proportion of 0.03 % by volume. The greater the bacterial activity in the soil, the greater the production of CO_2 and the stronger the current from the soil to the leaves. That activity in favoured by the number of times the soil is worked and by organic manuring. If the above-ground, gaseous, supply through the leaves is greater than the underground mineral supply through the roots, the plant is forced to store up reserves (starch, sugar, etc.) or to form organs which consume more especially carbon (C), such as flowers. If, on the contrary, the underground supply is greatest and more especially the supply of nitrogenous material, the plant forms organs whose construction requires plenty of nitrogen, such as leaves, leaf-buds, chlorophyll-containing parts. Variations in lighting and in in the supply of water or CO_2, according to the periods of growth in which the plant happens to be, suffice, according to BORNEMANN, to lead the crop in one direction or another so as to give a greater yield. Leguminous plants, potatoes and root crops only give high yields, if they are under high carbonic pressure ; the author deduces from this their preference for organic soils. In these crops the supply through the roots should first be increased by an abundant supply of nitrogen and water, until great leaf surface is developed ; after that up to harvesting, supply through the roots should be restricted and supply through the leaves increased by means of weeding and sparing use of nitrogenous manures and watering ; it is only in this way that heavy crops of beet can be obtained.

Cereals use the soil chiefly in the earlier stages of growth. BORNEMANN states that tillering is affected by a high carbonic pressure, but when the stalks begin to lengthen (" Schossen "), and the leaf surface decreases with diminished carbonic pressure, the aerial supply also tends to take the lead because of the progression of the season and of the lighting. But to bring to complete maturity all the numerous ears the supply through the roots must always be kept ahead of the aerial supply until the commencement of maturation, by means of a cover dressing of soluble salts (1).

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(1) It is, however, known that at least in southern countries, cover dressings of nitrates in late spring, very often decrease the grain yield of cereals (*Ed.*)

The ratio of the two alimentary factors is not easy to regulate in the case of oilseed crops.

Leguminous plants, owing to the ease with which they obtain their requirements in nitrogen, water and mineral substances by symbiosis or by the effect of their powerful root systems, make the best use, according to the author, of high pressures of CO_2, the reason why the periods of growth are shortest when the production of CO_2 in the soil is highest. If the carbonic pressure is increased, the first flowering is earlier and more numerous and the stalks are shorter.

According to BORNEMANN these conclusions are experimental and the author gives an account of some of them.

A fine, calcareous, clay-loam soil, which produced only 1 to 2 litres of CO_2 per square metre per day was covered by a close-meshed wire frame, to prevent damage by birds; under the cage a rectangular piece of earth was loosened which ran longitudinally east to west and was 1 50 metres wide; it was subdivided into 12 plots 84 cm. wide. A special system of metal tubing, placed level with the surface of the ground and formed of tubes pierced with small holes placed in the middle of the plots and attached to a orthogonal collector, served to distribute the gas to the 6 plots on the east only. Each pair of plots, one of which received gas and the other none, was cultivated as follows:— 1 and 1′ winter wheat, 2 and 2′ oats; 3 and 3′ Victoria peas, 4 and 4′ barley; 5 and 5′ broad beans; 6 and 6′ white mustard. Nutrient solutions were applied during growth, and the ground was kept constantly moderately moist, free from weeds, raked and hoed. The distribution of CO_2 through the system of tubes commenced on April 7, 1919 after the stalks had lengthened, and was continued without interruption up to the following July 13, 10 hours a day with 68 gm. of CO_2 per square metre, that is to, say to the extent that good organic manuring, would provide, theoretically, in decomposing.

The distribution of gas to the wheat commenced after tillering. When the stems began to increase in length, the leaves of the wheat which had been given gas measured 3 to 4 cm. more in length; the stems were thicker and, consequently, the ears were larger and thicker. The lodging of this wheat took place 8 days late.

The ratios between the yields of the treated and untreated plots at harvest time are given in the following table:—

The author remarks that the yield of wheat which was treated with gas would have been greater if the distribution of the gas had commenced earlier and if the supply through the roots had been more abundant. As regards the oats and the barley also, the author thinks that the supply through the roots was insufficient both in proportion to the greater leaf area and to the stronger pressure of the carbonic acid gas (1).

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(1) These experiments have been described by BORNEMANN himself in his recent work *Kohlensaure und Pflanzenwachstum*, p 84 Berlin, Parey, 1920 (*Ed*)

	Wheat	Barley	Peas	Beans	Mustard
Total weight of plants	1.28	1.40	1.28	1.59	1.49
Total weight of seed	1.20	0.82	1.34	1.76	1.23
Total number of ears	1.02	1.29	—	—	—
Weight of grains of one plant .	—	0.94	—	—	—
Weight of grain in one ear . .	1.19	0,73	—	—	—
Number of seeds per pod . . .	—	—		1.13	—
Weight of one pod	—	—	—	1.26	—
Weight of seeds from one pod.	—	—	—	1.44	—
Weight of 1000 seeds	1.14	—	1.12	—	1.15
Weight of one hectolitre. . . .	1.024	—	1.04	—	1.02

BORNEMANN further concludes that :— 1) The formation of badly nourished grains "Schmachtkorn,, does not depend on an excessive supply of nitrogen but on an excessive supply of carbonic acid, especially during tillering; 2) the more humiferous and active the soil, the greater the production in it of CO_2, the more extensive is the tillering. and the greater the need of dressings of mineral fertilisers (nitrogen included) and in larger quantities than is usual; 3) if the supply through the roots is endangered, owing to drought or other causes, all agricultural operations which favour tillering should be avoided. This new idea furnishes a perfect explanation of many contradictions which are noticed in practice.

Leguminous plants make the best use of farmyard manure as a source of CO_2; the author therefore considers that they should be grown with a mixture of farmyard manure and fertilisers. Next to the leguminous plants come plants with oleaginous seeds.

II. RECENT RESULTS OF CARBONIC MANURING. — FISCHER related the results obtained, in 1919, in the carbonification field installed by RIEDEL at Horst, in the Ruhr district (1). It should be noted that carbonication was interrupted and that the plots treated were on the worst soil.

In spite of that, mangolds treated in the open with carbon dioxide produced, for the first crop 1.7 times more than those not treated and 1.46 for the second crop, fennel 1.36, sugar-beet 1.52, soy bean 1.15 to 3.08, *Lupinus termis*, a plant as yet little known but of appreciable value, 2.52; haricot beans, 1.48. Under glass the tomato gave 3.67 for the early partial pickings and 1.47 for the total crop.

FISCHER states that carbonication produces its maximum effect when all the other factors of production are increased and consequently the fertilisers also; that agricultural gas plants for non-biological CO_2 are only possible near factories; that, for ordinary agriculture, biological CO_2 must be used, produced by the organic matter in the soil, according to BORNEMANN. However, the experiments made by HORST prove that

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1) See *R.*, June 1920, No. 626. (*Ed.*)

the actual content of CO_2 in the air does not constitute an optimum for crops.

III. GASSING PLANTS WITH CARBON DIOXIDE — CLAASSEN criticises the partisans of carbonic manuring; he does not deny the facts but he does not see by what means industrial, non-biological carbonication can be applied to farming on a large scale. The author believes that, in the experiments hitherto made, the difficulties of purifying and distributing CO_2 resulting from the iron and steel industry have not been sufficiently considered, whilst the additional value of the increments of production is exaggerated. He considers that the increased yield would not cover the costs of interest and amortisation of the purifying apparatus, fans, and the systems of piping for supplying the gas and the cost of working them.

He states that the whole of the CO_2 available in Germany would only suffice for gassing 270 000 hectares and that, consequently, the method could only be applied to farming on a small scale and under glass, while for farming on a large scale the increased carbonic pressure and, consequently, the increased crop, could only be obtained by means of organic manuring, irrigation and suitable preparation of the soil (1).

REINAU, replying to CLAASSEN states, that what he calls "automatic" carbonic manuring, that is to say derived from the decomposition of organic residues in the soil, is certainly the most practical method. REINAU is therefore in agreement with BORNEMANN, who is now studying, with the firm of LANZ, the degree of activity of that decomposition by means of rotary tillage of the soil. But he points out that by taking some trouble the blast-furnace industry could furnish for many weeks pure CO_2 in sufficient quantity.

Regarding the high cost of installation of the distributing pipes. REINAU thinks that the fields for utilising the Berlin sewage (" Rieselfelder ") would require a much greater expenditure than RIEDEL has calculated for gassing. He further expresses the opinion that if the State, for reasons of hygiene, contributes to the cost of agricultural distribution of residues of sewage, it might, for the same reasons, contribute to the cost of installing tubes for delivering CO_2.

REINAU also quotes his previous work on the action of wind with reference to carbonic manuring.

BORNEMANN also replies to the remarks of CLAASSEN; he declares that he has no doubt that gassing with industrial CO_2 will cause an increase, even of 100 %, in the crops, but that at present it is a matter for technicians to solve the problem in the best way. In the present state of affairs non-biological gassing should be limited to kitchen-gardens and gardens, while farming on a large scale only has at its disposal automatic (biological) gassing, for which it is necessary to make a study of the best means to obtain an increased production up to 100 %. It is not possible to deduce from the results of laboratory experiments, as CLAASSEN has done, that, to gas 1 hectare, 100 tons of CO_2 are required, because in the open the economy of CO_2 would be greater. Experiments made on sugar beet, mentioned by BORNEMANN in his recent work, show, on the contrary, that the yield of sugar per ha. can he doubled, and with a good economic result (1).

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(1) This part of CLAASSEN's criticism has been translated in *Sucrerie, Distillerie, Industries agricoles*, Year 1, No. 1, p. 20. Paris, March 1921. (*Ed.*)

CLAASSEN replies to these remarks that small-scale experiments should be given up, and that it is not right to charge the State with a portion of the expenditure on the pipes. The opinion of BORNEMANN should also be confirmed by repeated experiments on a large scale, all the more as it appears difficult to procure the large quantities of organic manure required.

IV. CARBON DIOXIDE AND PLANTS. — This is a criticism of the recent work published by REINAU (2) RIPPEL denies the practical importance of artificial distribution of CO_2 to plants. It is true that according to MITSCHERLICH, PFEIFFER, and KREUSLER the CO_2 of the air may become a minimum factor, but RIPPEL avers that generally it is not so, since in the last 10 years the relative crops have everywhere increased without gassing and merely by increasing the soil content of nitrogen (N), phosphorous (P), potassium (K) and water (H_2O). Furthermore, REINAU furnishes no proof that carbonic gassing alone increases the crop and as it has not been proved that the CO_2 plays a special rôle, it should only be classed in the category of factors of growth below the optimum.

REINAU thinks that carbonic endosmosis is caused in the leaf, according to physical laws, by the slight potential difference between the partial carbonic pressures outside and inside the leaf, but RIPPEL affirms that carbonic assimilation is regulated by light which is the effective cause of it; it is therefore the plant which regulates the potential difference and not *vice versa*. Physiological phenomena are not explained by physical laws alone.

It would be fantastic, according to the author, to try to deduce from the results of laboratory experiments that the increase of the percentage of CO_2 in the air from 0.0300 to 0.0302 % would cause an increased yield of 20 % in a crop grown in open fields.

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(1) The author refers to field experiments made in 1917 by SCHULZE, on the advice of BORNEMANN, in Westphalia, in a very rainy district, on 4 ha. of land under intensive cultivation, with a tendency to compactness, but poor in colloids and rich in very fine sand. The experiment was to determine whether with an abundant mineral manuring (including nitrogen), a heavy application of farmyard manure resulted in a large increase in production when the farmyard manure was dug in superficially shortly before sowing and then submitted or not to rapid decomposition by means of rotary tillage with a LANZ "Agricultural motor". The crop on the land thus tilled gave 416 quintals of potatoes against 352 quintals on land tilled, that is to say where the manure had not been unearthed. Sugar beet gave respectively 528 quintals of roots with 17.9 % of sugar against 292 quintals with 16.4 %. See F. BORNEMANN, *Kohlensaure und Pflanzenwachstum*, pp. 101-102. Berlin, Parey, 1920. (*Ed*)

(2) E. REINAU, *Kohlensäure und Pflanzen. Ein Beitrag zur Kohlenstoffdungung der Pflanzen und ein Versuch zu einer geophysischen Pflanzenphysiologie.* Halle, Knapp, 1920. See the reviews in *Biedermann's Zentralblatt*, 1920, p. 252 and in *Chemiker Zeitung*, 1920, p. 208. (*PT*)

RIPPEL concludes from this that further experiments with carbonic manuring are necessary, which will not become a pressing matter until growth due to N, P, K and H_2O in the soil has reached the optimum limit, a condition which is far from realisation.

V. OPINIONS ON THE PROCESS OF CARBONIC MANURING WITH WASTE GASES. — RIEDEL refers to his previous experiments and then criticises the preceeding remarks of CLAASSEN.

He avers that it is possible to get pure gas from blast furnaces, and that large installations of tubing for conveying the gas supply are no more difficult than for water supply, lighting, etc. HORST'S experimental field for gassing which had an area of 30 hectares was fitted up industrially; since manifest indications of gassing can still be seen on the edges of this field it follows that in practice the area to be gassed can be as extensive as is desired. The distribution of gas can easily be regulated and rendered uniform during the day and an excessive concentration injurious to the crops is not to be feared Experience will show what degrees of concentration are most useful.

The economic expediency of these gas pipes in agriculture is most favourable, especially near blast furnaces situated at a lower level them the fields to be gassed. In the neighbourhood of foundries there is also, the technical and economic possibility of gassing thousands of hectares, at a cost to the farmer of only the main pipe, the distributing pipes and the cost of establishment. But economy is not compromised even in the case of large fields separated from the factories by several kilometres of piping. The branch pipes 25 m. apart and 100 m. long only require 100 m. per *morgen* (¼ of a hectare) of cement piping of 10 cm. diameter, and with some petty repairs they will almost last for ever.

The power required to force the gas through the pipes is also moderate if provided by a fan and almost nil (in cost to the farmer) if done by large gas machines.

RIEDEL states that if lupins treated with gas are worth, green, 2.7 times the value of non-treated lupins, in a dry state they are worth 2.9 times the value of non-treated lupins. Thus, BORNEMANN obtained, with mangolds, 85 % increase in roots as well as an increase of 1.5 % of sugar. Gassing therefore makes the root less watery and more savoury.

The author agrees with CLAASSEN and BORNEMANN as to the necessity of encouraging automatic carbonication of soils, but it cannot be denied that pipes for carbonication already work successfully where conditions are favourable and their use should be extended.

Appreciable results will have been obtained if only a few hundred thousand hectares in Germany are treated with gas (1).

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(1) BAGERON, who has translated and annotated RIEDEL'S experiments, thinks that the experiments should be repeated in France near factories in Lorraine, Normandy and in the Pyrenees Cf *La Vie agricole et rurale*, Year 10, Vol. 18, No 6, p 85 Paris, Feb 1921,

VI. CARBON DIOXIDE AND THE GROWTH OF PLANTS. — BORNEMANN affirms that from experiments made by hims elf and by others it has been shown that well manured and well cultivated soil furnishes more CO_2 than the same soil not manured and badly cultivated. He tries to prove that the greater fertility of the former is due, at any rate in part, precisely to its greater production of CO_2. Soil and experimental arrangements were as in the previous experiments of the same author, the plan of which is given in the text. However, the carbonication is not automatic; it is obtained in the regular method (from non-biological sources) by means of pipe distribution. There was no variations in the conclusions whether the experiments were made with peas, oats, barley, potatoes, onions or turnip-cabbage; they were invariably in favour of non-biological carbonication, which gave increased production which, in the case of onions, reached 210 % (1).

VII. CARBONIC NUTRITION OF CULTIVATED PLANTS. — PFEIFFER, wishing to criticise BORNEMANN'S conclusions made pot experiments from which he concluded that large yields can be obtained even on pure sand without any organic matter and consequently without any CO_2 from the soil.

BORNEMANN observes that results from pot experiments cannot be applied and generalised to hectares by transforming into an *area* of ground small *spaces* occupied by plants. Moreover his experiments on 3 growths in pots, the 1st with air to which CO_2 was added, the 2nd with ordinary air and the 3rd with air from which CO_2 had been abstracted, have shown that, in the first case the plants grew rapidly, accumulated carbohydrates at an early stage or flowered abundantly but formed a their root system; in the second case the epigeal portion of the plant behaved as in the first case, but in a less degree, whilst the root system was ample; in the third case, the growth was purely vegetative, without accumulation of any reserve material, without flowers or lignification in the stalk; the leaves were large but delicate in texture; the root system is still larger and, in the oat, it even developed in the air. These phenomena are due, according to BORNEMANN, to the different nutritive ratio, nitrogen : carbon (N: C) and they could be used analytically.

As it is certain that the plant can profitably assimilate a larger amount of CO_2, the question lies in the way it is to be supplied. The author begins by abandoning all idea of using industrial carbonication, as proposed by RIEDEL, in farming on a large scale, and he thinks that the great practical problem can only be solved by the help of biological carbonication.

JESS also draws attention to the same subject in France. Cf. *Journal d'Agriculture pratique*. Year 85, Vol. 12, No. 12-13. Paris, April 1921. (*Ed.*)

(1) GEHRING comments favourably on these experiments of BORNEMANN and states that by their simplicity and clearness they again prove the great importance of carbonic manuring and that these results are also confirmed by his own experiments made in the summer of 1920. Cf. *Zentral-Blatt fur die Kunstdünger-Industrie*, Year 26, No. 2, p. 13. Frankfort-on-Maine, Jan. 15, 1921.

Certainly the present state of agricultural science does not enable the high positive function of the increase of carbonic pressure to be completely explained, but there are plenty of things which science cannot yet explain; science has not, up to the present explained the relationship between root respiration and leaf turgescence or assimilation. This root respiration and the production of CO_2 which results from it, as well as the influence which the mechanical structure of the soil exerts on it, may explain phenomena the reasons for which are at present unknown In an experimental culture of hemp made in Westphalia, in rotary-tilled soil, one plot was rolled before sowing in lines, the other after sowing; in both cases a light harrowing was given directly after sowing In the rolled plot the height of the hemp was 40 cm. less than in the plot not rolled. The author asks what is the cause and adds that although treatises on plant physiology furnish plenty of information about root respiration, an experment throwing light on the relationship between assimilation and such rules of cultivation, apparently of slight importance, muy be looked for in vain in them.

It appears to BORNEMANN that root respiration deserves special attention in the cultivation of root crops. The amazing increase in production obtained in the experiment with sugar beet (referred to above) was attainable because all factors of nutrition both of root and leaf were at an optimum and because rotary tillage, by producing a very high degree of porosity in the soil, did not permit of any reduction in the assimilation of carbon dioxide through the leaves which otherwise would have resulted from a reduction of root respiration. The author is certain that the sugar beet would give much higher yields in Saxony if, when preparing the fields, the carbonic nutrition and root respiration of the plants were kept in view.

VIII. CARBONIC FEEDING OF CULTIVATED PLANTS. — The same author repeats the objections which he had previously made regarding the pot cultures made by PFEIFFER, and he also replies to the remarks made by RIPPEL and AEREBOE by the arguments mentioned above He adds that he has previously shown that, in order to tiller, the plant should have in its organism a certain excess of assimilated material; this is why in shaded places oats do not tiller well if the soil does not produce CO_2. If the latter is wanting there is no tillering and the plant then develops a single good stem with a single good ear. If the CO_2 in the air is increased the plants are compelled to tiller and they do not accumulate any reserves for further stems so long as new buds are not formed. If, after tillering, the plant only finds the ordinary reserve atmospheric CO_2 it only develops stems from the principal buds that are shorter than the solitary stem of the plant which does not tiller. Thus, according to BORNEMANN, it is possible, by regulating the carbonic supply in a suitable manner, to regulate tillering, and the length, thickness and number of stems.

To study these phenomena of carbonic nutrition, the author recently made use of a prismatic glass box with a square section and moveable sides, the base of which was provided with a wooden frame which could be fitted to the top of a pot. The dimensions and an illustration are given in the text.

The author thinks that the following conclusions may be drawn from experiments made with this novel apparatus on Victoria peas:— 1) non-biological gassing was the controlling factor of the highest yield; 2) in pot experiments, production is also a function of the distance and the order of arrangement of the pots; 3) early death of the lower leaves is due to want of CO_2 and not to want of light; 4) it is confirmed that increasing the amount of CO_2 in the soil causes important increases in the yield.

IX. CARBONIC FEEDING OF PLANTS. — GODLEWSKI, KREUSSLER, and other writers have shown that the actual air content of CO_2 is not an optimum (1). Later, other investigators have expressed the opinion that the importance of the N, P and K in artificial manure ought to be attributed to CO_2. LEMMERMANN admits the certainty of increased production by non-biological industrial carbonication, but he considers that this method is suitable for glass houses and very valuable plants.

Regarding the opinion of BORNEMANN, that farmyard manure and green manuring are less useful to cultivation on account of their content in solid nutritive principles and the improvement which they make in the physical state of the soil than on account of the production of carbon by the CO_2 which they provide, its acceptance would lead to the conclusion that manuring should be done shortly before sowing or as a dressing for cereals; for example the best time would be when tillering commences. However, BORNEMANN does not prove this experimentally, and it is deduced from his carbonic theory, which equally lacks proof.

LEMMERMANN and his fellow-workers have never observed, in their pot experiments, a perceptibly greater production of CO_2 in manured pots than in pots that were not manured. At best they noted a daily production corresponding to 378 gm. of CO_2 per hectare in place of the 9 kg. which a manuring with 400 quintals should theoretically produce, allowing, for the first year, a decomposition of 25 %. In the open fields things occur differently and it is impossible to determine with accuracy the amount of CO_2 set free from farmyard manure or covered green manuring.

Carbon dioxide diffuses very slowly in the air, and it has not been shown how much of it is used as carbonic food for plants.

The result of a preliminary experiment on turnips in pots, all treated with abundance of complete mineral manure, some with the equivalent of 400 quintals of farmyard manure or green manure per hectare, others without, has been that these supplements of organic manure have not increased production.

From a second experiment with 4 series of smaller pots, filled respectively with earth only, earth + farmyard manure, earth + green manure, earth + pipes conveying CO_2 (equivalent to 54 kg. of CO_2 per ha. per day) and buried level with the soil in another larger pot full of the same earth treated with abundance of a complete mineral manure in which turnips grew in the space between the small pots, it resulted that the yields of the

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1) The *Journal d'Agriculture pratique* attributes to DEMOUSSY priority in researches on carbonic manuring. (*Ed.*)

4 large pots were almost identical; the action of farmyard manure, green manure and CO_2 in the small pots must therefore be left out of account in the organic synthesis of the turnips in the large pots

Field experiments with beet made in a similar way have confirmed that farmyard manure and green manure do not exercise an appreciable influence on the crop so far as the assimilation of carbon through the leaves is concerned. The question being most important, LEMMERMANN states that he intends to continue his researches.

X. CARBONIC FEEDING OF PLANTS AND FARMYARD MANURE. — GERLACH takes part in the discussion by relating new experiments made by himself and fellow-workers, at Bromberg, under glass, by charging the air with carbon dioxide from cylinders, like BORNEMANN. During the different years, the increases (+) or decreases (—) caused by non-biological carbonication of the air and expressed in % of the dry matter produced by the non-treated pots were as follows: —

1916	Oats	+ 15 to 20	1918	Salad	— 31
1917	White mustard	+ 18	1919	Tobacco	+ 5
»	Carrots	— 4	»	Maize	+ 7
1918	Blue lupins	+ 14	»	White mustard	— 25
»	Garden haricots	+ 6	»	Tomatoes	— 25

Moreover, the carbonication did not always cause early flowering.

All these results agree with those obtained by LEMMERMANN at Berlin, but they are in opposition to those of BORNEMANN at Heidelberg, which leads GERLACH to deny the practical importance of non-biological carbonic manuring.

Regarding the other opinion of BORNEMANN on the subject of the possibility and utility of biological carbonication which SCHNEIDERVIND (1) considers plausible, GERLACH recalls that, in his first report, he concluded by stating that this influence of farmyard manure has been exaggerated. Field experiments, in plots of 1000 sq. m made in duplicate at Pentkowo, on sandy clay soil, from 1900 to 1912, have demonstrated that the use of farmyard manure (150 quintals per ha) raises the production of wheat but that a stronger dressing of complete mineral manure increases it quite as much and even more; the positive action of farmyard manure should therefore logically be brought down to its content of N, P and K, and not its provision of CO_2. For sugar beet the replacement of the dressing of farmyard manure (100 to 300 quintals per ha) by subsequent dressings of mineral manures reduced the average yield of roots by 4.8 % and the yield in sugar by 7 %. But GERLACH observes that these differences come within the experimental error and that at any rate, the action of CO_2 should be excluded because the yield in leaves was, with mineral manure alone, 2 % higher than with a mixed manuring (farmyard and mineral manures). That manuring produced, it is true, higher yields for weeded plants, but no experiment proves that this was the result of the CO_2 which was produced there; it is much more reasonable to attribute these advantages of the mixed manuring, first to the N, P and K of the farmyard manure or of the green manure and to the improvement of the physical properties of the soil and, next to the gradual, slow and benefical re-stocking of substances assimilable through the roots, without running the risk of temporary but harmful, nutritive concentrations, or of abnormal reaction of the soil.

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(1) Die Ernährung der Landeskulturpflanzen, 2nd Ed., p. 231.

Other experiments on the after-effects of farmyard manure on the same field of Pentkowo show that crops of potatoes, oats, rye, barley, wheat, in the second year, where only the chemical manuring had been repeated and which succeeded crops manured in the first year with or without farmyard manure, gave on an average, compared with unmanured control plots, an increased yield of 48 % for crops grown on plots treated the preceding year with a single dressing of complete mineral manure, and increases of 73 to 74 % for crops grown on plots treated the preceeding year both with farmyard manure plus a dressing of mineral manures and with only a double dressing of mineral manures. GERLACH does not understand how this remarkable after-effect of farmyard manure can be attributed to an abundant carbonic supply

Here the farmyard manure was applied in the usual way, but the first experiments of LEMMERMANN on the method of using farmyard manure gave results contrary to those of BORNEMANN, and for this reason GERLACH advises that fresh experiments should be made

In the present state of affairs the author thinks — 1) that it is very risky to advise farmers to use farmyard manure shortly before sowing or as a dressing; 2) that up to the present, proof that farmyard manure furnishes the leaves with CO_2 is entirely lacking.

705 - **The Use of the Ash of *Atriplex Halimus* as a Fertiliser.** — COULOUMA, J., in the *Bulletin de Pharmacie du Sud Est*, reproduced in *Bulletin agricole de l'Algérie, sie, Maroc*, 2nd Series, 27th Year, No 4, pp 66 67 Algiers, April 1921

Atriplex Halimus ("blanquette" in French and "guetaf" in Arabic), formerly restricted to the coastal belt in Languedoc, has gradually spread all over the large stretch of tertiary soil round Béziers. It is common also on the secondary soil of Montpellier (1) The ash of this plant contrary to the general rule, is not carbonated or alkaline but chloride. Round Béziers in September its analysis gives over 66 % of potassium chloride or 42 % of potassium oxide, and less than 1 % of sodium chloride. On the sea coast, the ashes of "blanquette" contain slightly less potassium chloride but they still yield 58 %.

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(1) The habitat of this Chenopodiaceous plant includes the coastal zones of the Mediterranean, South Africa, America — G ARCANGELI, *Flora italiana*, Loescher, 1894, p 211 (*Ed*)

"Guetaf" covers large areas in Algeria "Guetaf" soil often bears five crops of hard wheat. (*Note by the Ed of Bull Agric de l'Algérie, Tunisie, Maroc*)

Potassium chloride represent $^1/_8$ of the green plant. Analyses made by the author gave :—

Ash	37.26 %	of the dried leaves.
Sulphates	0.80 %	» » »
Potash (K_2O)	42..09 %	of the ash
Chlorine	32.07	» » » »
Alkalinity as Na OH	1.90	» » » »
Potassium chloride	66.55	» » » »
Sodium chloride	0.58	» » »
Insoluble	21.20	» » »
Silica and alumina	3.63	» » »
Lime	11.80	» »
Magnesia	3.08	» »

The ashes are slightly greenish in colour, due to a metal which it has not been possible to determine.

The author recommends the introduction of this plant, which spreads very rapidly, into waste land, and the utilisation of its ash as a potassic fertiliser

706 - On Papilionaceous Seeds with Spontaneous Sulphuretted-Hydrogen Fermentation.

— MIRANDE, M., in the *Comptes Rendus des séances de l'Académie des Sciences*, Vol. 172, No. 19, pp. 1202-1204. Paris, May 9, 1921.

In a previous note (1), the author showed that seeds of *Lathyrus sativus* and *L. Cirera*, which cause the poisoning known as lathyrism, crushed and moistened with a little water underwent aften a few hours, spontaneous fermentation indicated chiefly by a fairly active evolution of sulphuretted hydrogen. Afterwards he found that this property was fairly common among Papilionaceous plants, *e. g.*:— In *Lathyrus odoratus*; all the haricot beans (*Phaseolus vulgaris*); the peas (*Pisum sativum*); the broad beans (*Faba vulgaris*) amd their varieties, notably the Kidney bean (*Faba minor*); various species of *Vicia*; the chick pea (*Cicer arietinum*); and lucerne (*Medicago sativa*).

Other species also gave off H_2S but in smaller quantity, *viz.* :— Lentils (*Lens esculenta*); sainfoin (*Onibrychis sativa*); *Trifolium hybridum*; *Ervum Ervilia*; *Anthyllis Vulneraria*; *Cytisus Laburnum*; *Medicago Lupulina*; *Robinia Pseudo-Acacia*; *Lotus Corniculatus*. Among the lupins, *Lupinus albus* gives a spontaneous sulphuretted hydrogen fermentation as intense as that of the vetches, whereas *L. luteus* and *L. varius* appeared to emit no sulphuretted hydrogen. Some other Papilionaceous plants do not produce H_2S; as for example :— *Amorpha fruticosa*, *Genista tinctoria*, *Melilotus officinalis*, *Coronilla varia*, *Galega officinalis*. The author made equiries to see whether similar facts were previously known: in 1903 GOLA (*Malpighia*, Vol. XVI, 1903, and Vol. XVIII, 1904) noted a fermentation, differing in detail from that described by the author, but also producing H_2S, in the seeds of *Acacia Farnesiana* and of a fairly large number of species of the same genus.

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(1) See *R.*, June 1921, No. 641 (*Ed.*)

In unbroken seeds the faculty of producing sulphuretted hydrogen, whilst becoming feeble after a time, seems to endure for a long while, thus broad beans about 20 years old still gave a slight, but appreciable, emission of H_2S. The reason why peas and haricot beans do not generally cause any harm to persons eating them is because people do not eat them in a dried and uncooked state. During cooking an emission of H_2S takes place and the water in which they were boiled continues while warm and later when cold to give off H_2S. Now it is well known that food, soup for example, prepared with the water in which haricot beans have been boiled, causes digestive troubles. Peas, the split peas of commerce, have similar effects.

Fresh haricot-bean flour gives off H_2S as strongly as that of the vetches. As it gets old, the flour loses much of its power of emitting sulphuretted hydrogen ; simple contact with water vapour in the air causes slow spontaneous fermentation and loss of H_2S.

Bread made with a mixture of wheat flour and fresh flour of haricot beans showed, in spite of baking, appreciable traces of H_2S. On the other hand with haricot-bean flour exposed to the air, the author no longer found H_2S. But these facts show that feeding on bread made with haricot bean flour may cause digestive troubles.

These facts can be compared with those mentioned by CORNEVIN (*Des Plantes vénéneuses*, 1887, p. 328), relative to seeds of vetches and lathyrism: that author remarked that baking does not remove the poisonous properties of bread made with vetch flour ; the same is true of boiling. His experiments proved that in boiling the poison is partly given up by the water but not completely volatilised and that the injection of that water into an animal always causes death. On the other hand, still quoting the same author, seeds when cooked or boiled lose the greater part of their toxicity and do not cause harm if the water in which they were cooked is thrown away.

707 – **Resistance of Oil Seeds to Prolonged Heating.** — GAIN, A., in the *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXIV, No. 17, pp. 887-888. Paris, May 14 1921.

Oil seeds resist high temperatures better than starchy seeds. The author has found that a temperature of 50° C. maintained for 2 months in a dry stove has no action on seeds of flax, colza and sunflower. Seeds of these plants kept at 60° C. for 1 month, after a preparatory period of 3 days at 50° C. and subsequently kept at rest at ordinary temperature for 1 month before sowing, produced plants which showed no difference fom control plants.

WOROBIEW (*Khosiaistwo*, Year 10, p. 1075, Kiew, 1915) found a delay in germination in wheat seeds that had been heated and notable distinctive characters in the morphology of the plants grown from heated seeds. The author's tests with oil seeds gave uneven results Generally, he recorded earlier germination, especially for sunflower seed, but sometimes germination was slightly retarded.

Flowering is generally a little earlier and fructification a little more advanced with plants grown from heated seeds, but the latter result was not general. The vigour of the plants is not affected. By further increasing the temperature of heating, it is evident that the less vigorous seeds may be destroyed. Thus a method of heating seeds, worked with discretion, might, in genetic laboratories, be a convenient means of improving the homogeneity of lots before sowing. Knowing the range of critical temperatures for a given seed, it would be possible to heat the seeds at a temperature *T*, for a period of time *N*, and a selection would be effected which would give, for the plants raised from the seed which resisted heating, an individual average yield in weight higher than would be the case if all the initial seeds of the lot germinated.

708 – **The Effect of Temperature Upon the Ripening of Sweet Maize.** — APPLEMAN, O. CHARLES, and EATON S. V., in *Journal of Agricultural Research*, Vol. XX, No. 11, pp. 795-805, Washington, March 1, 1921.

Sweet maize is considered ripe when the growth of the kernels ceases, and the chemical changes have nearly attained equilibrium. The maturing of the grain consists essentially in the loss of water.

The chief changes in the percentage composition of the grain during ripening are the progressive decrease of the sugars and the increase of the starch.

Changes in the composition of sweet maize during ripening
(calculated as percentages of dry weight).

	Starch	Cane sugar	Reducing sugars	Fat	Crude fibre	Total nitrogen	Protein (N × 6.25)
August 3 . .	18.36	19.55	20.07	2.90	7.92	3.33	20.81
» 9 . .	45.42	18.75	5.43	4.44	2.58	2.09	13.06
» 19 . .	60.41	5.85	1.77	6.01	2.30	2.20	13.75

In the very early stages of ripening, the reducing sugars predominate; therefore the stage of highest total sugar content does not necessarily coincide with the stage of greatest sweetness.

Calculated as percentages of dry weight, the changes in fat, crude fibre and total nitrogen occur during the very early stages of ripening, and subsequently remain fairly constant.

The rate of starch synthesis in the kernels seems to be the controlling factor for several supplementary processes. For example, the rate of movement of soluble carbohydrates from the stems and cob to the kernels, and the rate of hydrolysis of cane sugar in the kernels are both controlled by the rate of starch formation. Most of the starch that is stored in the kernels during ripening is formed from carbohydrates already present in the stem and cob when kernel formation begins.

Temperature is, without doubt, the controlling factor for the ripening of sweet maize. If two crops from the same source of seed were planted so that the first would ripen in August, and the second in the cool autumn, the late crop would require 15 days to reach the same stage of ripening as the earlier one attained in 6 days. During this period, the starch content would increase from about 2.5 % to 10.5 % in the first case, and from about 2.7 % to 10 % in the second, while the sugar to starch ratios at the end of this period would be 0.556, and 0.500 respectively.

The authors used several temperature indices in order to estimate the effect of temperature upon the ripening processes; they obtained the best results with exponential indices. Upon the basic assumption that the growth rate is unity at 40° Fahrenheit (4.44° C.), and that it doubles for each rise of 18° F (10° C.), they deduced temperature efficiency values corresponding to temperatures, in whole numbers, from 40° to 99° F. (from 4.44° C. to 37.22° C.); these efficiency values are spoken of as exponential indices.

The rate of ripening being inversely proportional to the exponential indices, a basis was furnished for an approximate prediction, from the meteorological data, of the number of days required for the maize to ripen in different localities, and at different seasons.

709 - **Grafts of the Sunflower on the Jerusalem Artichoke** (1). — DANIEL, L., in the *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 172, No. 10, pp. 610-612. Paris, March 7, 1921.

It has long been known that when a sunflower is grafted on to a Jerusalem artichoke the latter produces reduced tubers but nevertheless stores inuline and becomes less vigorous in growth. It may be asked whether, as has recently been stated, the inuline thus stored is derived, exclusively or almost so, from the dextro-rotary products elaborated by the sunflower graft. If so, the amount stored by the plant in different cases should be approximately proportional to the relative growths and weights of the grafts at the end of their growth, as is the case when *Helianthus orgyalis* is grafted on Jerusalem artichokes, which, like them, produces inuline and grows in a very similar way. With the object of solving this problem, the author made, in 1920, two series of grafts of sunflowers on Jerusalem artichokes and noted that there was no proportionality between the weights of tubers produced and the weights of the grafts.

From this it must be concluded that the reserves formed by Jerusalem artichokes grafted with sunflowers are not derived exclusively or almost so from materials elaborated by the latter, which draws them back into its seed at the time the plant commences to form tubers.

The inuline of the grafted Jerusalem artichoke may originate in two ways:— 1) It comes entirely from the laevo-rotary products produced by the chlorophyll of the stock, whose action is not negligible when the stalk is 80 cm. high, and also from the action of the shoots continually formed by the stock which are difficult to suppress before they have assimilated, however carefully they are looked over; 2) or else it comes only partly from those sources and the remainder from the movement of the reserves of the original tuber, which then behaves similarly to the potato, forming small tubers at the expense of the old one consequent upon a sudden slowing down of growth or to special conditions that hinder its normal development.

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(1) See, *R.*, April 1920, No. 403; *R.*, Feb. 1921, No. 142 (*Ed.*)

710 - **Improvement of Certain Cultivated Tropical Plants by Selection at the Phytotechnical Station of Porto-Rico.** — BARKER, E. E, in the *Gobierno de Puerto Rico, Departemento de Agricultura y Trabajo, Estación Experimental Insular, Circular* No. 30, pp. 1-28. San Juan, P. R., July 1920

Synthetic account of selection work done, or being done, at the Phytotechnical Station of Porto-Rico. The improvement of cultivated plants can be obtained by vegetative methods, by isolating and propagating the varieties by bud, or by sexual methods, by means of selection, or by hybridisation accompanied by selection.

SUGAR-CANE. — Bud variations are fairly common in sugar-cane. Such is the origin of the uniformly light coloured " Cristalina " and of the uniformly dark coloured " Cheribón ", both derived from the light and dark striped " Rayada " The results obtained by selection are much more important; for instance P. R.-260 obtained at the Porto Rico Station. At the present moment the cultivation ot sugar-cane in the island is seriously threatened by root-disease. As a remedial measure, the author recommends crossing the variety " Cristalina " with the north-Indian variety " Kavangire " which is proof against that disease.

TUBER-BEARING PLANTS — Even a superficial examination of the products of tuber-bearing plants such as the sweet potato, the potato, the " malanga " (*Colocasia esculenta*) suffices to show how heterogeneous they are; great differences in respect of productivity, shape, size and colour of the tubers are met with in different plants. There is no doubt that it would be possible by line selection to obtain more productive and more homogeneous types.

The following process may be followed:— When harvesting, the plants which produce the greatest number of tubers are selected and kept separate; these are the most productive plants. Selection is then made according to shape and size, aiming at a type of medium size and uniform surface, without protuberances and flaws

The tubers of the plant which is most productive and unites the desiderata relating to shape, size and colour will be kept for seed. At the next harvest fresh sorting will be done and inferior specimens and those of plants which have proved incapable of transmitting their positive characters to their descendants are eliminated. The best tubers are set apart for sowing in a new " cuadro de experimentación " (experiment plot) and the remainder for ordinary sowing. This process goes on from year to year. The number of first class tubers varies each year according to the crops. The author reckoned on 500.

TOBACCO, RICE, MAIZE, COTTON. — These plants are exceedingly heterogeneous both as regards production and quality and resistence to adverse weather or to diseases due to fungi. In all these cases selection can give good results.

FRUIT. — *Citrus myrtifolia* (Chinese), Seville orange tree, mango tree, *Persea gratissima*, produce fruits very different in volume, shape, quality, quantity of seeds, sugar content, colour, structure of the pericarp and time of ripening. Some are distinguished by their heavy production, others by small production. The author insists on the expediency of fixing the characters of the best plants, which should then furnish grafts and thus give rise to new selected commercial varieties. The author, with this object, appeals for the collaboration of horticulturists in the island for discovering and describing the best trees, taking into account the earliness or lateness of ripening, the succulence of the fruit, acidity, flavour of the fruit and the number of seeds. What has already been done on a large scale for citrus trees in the United States might be applied here.

COCONUT PALM. — The plantations of this palm show very great variations between different trees; some have their leaves bent back and drooping, others have them erect, and notable differences of shape and size are also met with. In the plantations at the Station there are trees which produce 100 (some as many as 140) nuts a year, whereas others, although normally grown, only yield 5. There are also differences in the shape and size of the nuts, the size of the seed, and the thickness of the exocarp.

All these qualities can be selected and it is certain that it would be possible in a few years, by means of a series of individual observations, to identify the palms which could most advantageously contribute to the regeneration and revival of the plantations.

COFFEE. — A similar procedure is followed for this shrub, by taking into consideration the quantity and quality of the berries produced by the best shrubs, the appearance and the rapidity of growth, etc. The propagation of the best types could be effected both by seed and by vegetative methods.

Form for observations relating to the coconut palm.

Number of leaves	Date of collecting and number of nuts picked at each collection	Total number of nuts collected in one year	Average dimensions of the nuts	Exocarp

Form for observations relating to the banana.

Variety . . . .

Plant No.	Date of collection of fruit	Weight per cluster	Number of bunches	Number of fruits per bunch	Number of clusters per plant in... months	Remarks

Form for observations relating to yam, potato, etc.

Variety . . . .
No. of entry . . . . Class No. . . . . . .
Sent by . . . .

	Marks compared with the standard type	Value of the individual examined compared with the standard type
Vigour and appearance	20	
Shape	20	
Uniformity (Predominance of the same characters in all tubers) .	15	
Purity of type	15	
Dimensions	10	
Structure (Dimensions of the grain of the flesh taken on a section of the tuber)	15	
Skin (colour, thickness, etc.)	5	
Total . . .	100	

BANANA. — Good results would certainly be obtained by applying these principles to the banana.

A few of the tables used for registering the agricultural and biometrical data are here reproduced to give a clearer and more detailed idea of the method adopted in carrying out the work.

For selection, Porto-Rico is a field which has not yet been worked from the stand-point of plant genetics: the results which may be derived from its application to the creation of more productive types and types more resistant to diseases and adverse weather will only therefore be all the more quickly attained and the more important.

711 - **Characteristics of Norwegian Spring Wheats Compared with those of Other Exotic Wheats, and their Improvement by Means of Selection.** — KNUT VIK, in the *Norges Landbrukshøiskoles Akervekstforsøk*, Year 30, pp. 7-36, 1 pl. Christiania, 1920.

The author first gives the results of comparative cultural experiments made with Norwegian and exotic spring wheats.

TABLE I. — *Results of a series of comparative cultural experiments of Norwegian and exotic spring wheats, during the period* 1910-1918.

Kinds	Weight of 1000 grains gm.	Weight of one hl. kg.	Duration of the vegetative period in days	Waste %	Yield in kg.	
					Straw	Grain
Børsum	29.1	78.0	112	21.6	427 kg.	105 kg.
Jekstad	—	—	111	20.4	100.0 %	103.6 %
Smebøl	28.6	79.9	112	23.6	103.3 »	102.6 »
Lerdal	28.6	78.9	111	20.9	99.4	100.4 »
Saastad	—	—	112	22.6	100.2 »	98.4 »
Messel	28.3	77.6	111	20.4	98.5 »	96.7 »
østby	30.2	79.0	111	19.8	100.2 »	95.3 »
Kolbe, Svalöf	34.2	77.9	119	15.9	110.6	93.2
Kolbe, Hagendahl	34.3	76.7	123	9.4	96.9	85.2
Montana (American)	—	—	115	21.7	107.17	83.8
Macaroni (American)	43.1	81.8	116	15.3	87.9	68.9

The Norwegian wheats give yields of grain decidedly superior to those of the exotic wheats, and this is certainly due to their shorter vegetative period which enables them to grow and ripen regularly before the autumn cold commences.

There is great possibility of improvement by means of selection in pure lines, for the indigenous varieties are mainly populations constituted by distinct and constant forms.

Norwegian spring wheat belongs to the indigenous type (Landhvete):— ears rather small, flattened and ending in a point; 2-3 grains per spikelet, on an average, rarely 4 (exceptionally 5); small grains (1000 weigh 30 gm.) with a glassy fracture, coloured or not; awns smooth; stalks thin and leaves small.

There are 4 principal forms:—

1) Bearded with brown ears (Snerpet brunakset)
2) Beardless with brown ears (Snerpløs brunakset)
3) Bearded with light ears (Snerpet hvitakset)
4) Beardless with light ears (Snerpløs kvitakset).

Beardless with brown ears. — This form is grown the most. It may practically be considered as beardless, although it really has a few awns at the point of the ear. The lower half of the ear contains more grains than in the bearded types.

Some lines of this type are noted for their high production in grain, which is due to resistance to fungoid disease, especially rust, brown rust, and *Erisiphe*.

Bearded with brown ears. — Awns from 5 to 6 cm. long or more; the brown colour is much more marked than in the beardless form; the 4 or 5 lowest spikelets are rarely fertile and the 2 lowest are often quite empty; the grains are elongated and more voluminous; it tillers less stronggly than the beardless form and the yield is also less, because of its greater susceptibility to fungoid diseases.

Besides this form, which is the commonest (type *a*), there is another, also *bearded with brown ears*, with denser spikelets and a greater number of grains. The grains, however, are rather small (type *b*).

Beardless with light ears. — This also has a few awns slightly developed towards the point of the ear, but quite beardless specimens are not lacking ; the ears are short and dense, and the grains slightly thicker and shorter than in the other forms. It yields less than the two preceeding kinds, and is very susceptible to the attacks of fungoid disease (*Erisiphe graminis* and *Tilletia caries*).

Bearded with light ears. — This kind has not been much studied by the author : in the form of its grains it closely resembles the form *bearded with brown ears.*

The data contained in Table II give a precise idea of the dimensions of the grains.

TABLE II. — *Length and breadth of the grains.*

	Beardless brown		Beardless white		Bearded brown (type *a*)		Bearded brown type *b*)	
	Length mm.	Breadth mm.	Length mm.	Breadth mm.	Length mm.	Breadth mm.	Length mm.	Breadth mm.
1915	5.86	3.10	5.65	3.09	6.22	3.07	—	—
1916	5.92	3.19	5.82	3.00	6.33	3.18	6.05	2.98
1918	5.93	3.36	5.80	3.32	6.35	3.26	5.99	3.11

In selecting by pure lines the existence of forms which might be isolated and propagated with advantage has been noted for each of the principal varieties.

The results of the work of selection for the year 1919 are summed up in Table III (See page 830).

In the group *Beardless with dark ears*, the lines Tr 03 and B 04 are remarkable for their high yield and high percentage of grains. Line Tr 08 is remarkable for the flattened shape of the grain.

In the group *Beardless with light ears*, there are at least 2 very distinct forms ; A 02 is characterised by its high yield of straw and grain, by its high percentage of grain, and of large grains as well as by the weight of 1000 of its grains.

In the group *Bearded with brown ears*, ø 06 is superior to the other lines by the small number of diseased ears, in yield of grain, percentage of grain and of large grains, and by the weight of 1000 of its grains : of all the lines tested it has largest grains ; K 09 is also very different from ø 06, and E 01 is characterised by its earliness. Mo 06 and Mo 07 are derived from a spring wheat from Montana, U. S. A. ; Mo 07 has very strong straw and the author has crossed it with the indigenous Norwegian with the object of strengthening the stalks of the latter.

TABLE III. — *Results obtained with a certain number of pure lines of Norwegian spring wheats.*

	Duration of the vegetative period in day	Infected ears per 15 sq. m.	Relative productivity		Percentage of grain	Weight of 1000 grains in gm.	Result of sorting			
			Straw	Grain			1 > 28 mm.	2 25-28 mm.	3 22-25 mm.	
Børsum	104	11	108	98	33.1	37.56	26.5	53.7	13.3	6.5
S 06	102	3	92	97	36 6	38.27	26.0	54.5	13.0	6.5
Me·01	101	0	103	101	34.7	36.15	16.9	60.9	14.9	7.3
Me 02	101	5	118	96	30.6	38.05	24.0	55.0	13.6	7.4
Tr 05	103	4	94	121	40.9	38.76	30.6	51.6	11.5	6.3
Tr 08	103	6	100	104	35,8	39.86	17.5	60.7	15.7	6.1
H 03	105	1	93	108	38.8	37.26	17.7	59.3	15.7	7.3
K 05	104	9	97	93	34.3	36.27	14.7	64.8	15.8	4.7
B 04	103	8	103	123	39.3	39.17	30.9	51.6	11.9	5.6
B 05	103	11	97	85	32.0	36.15	23.1	58.8	12.4	5.7
C 01	103	14	107	102	33.1	36.12	25.4	53.0	13.8	7.8
Average	**103**	**7**	**101**	**103**	**35.4**	**37.61**	**23.0**	**56.7**	**13.8**	**6.5**
Me 07	102	3	84	74	32.2	32.93	4.7	49.4	33.2	12.7
A 01	103	0	89	84	35.3	33 44	7.7	58.6	24.0	9.7
A 02	102	56	101	109	36.0	36.72	17.6	59.8	14.9	7.7
A 05	102	196	80	73	33.2	30.54	3.1	47.7	35.9	13.3
Average	**102**	**64**	**88**	**85**	**34.2**	**33.41**	**8.3**	**53.9**	**27.0**	**10.8**
Ø 06	100	7	104	127	39.9	42.37	69.0	22.7	5.1	3.2
K 0,	103	30	91	84	33.3	34.63	10.7	55.6	24.2	9.5
E 01	99	414	106	66	24.8	35.34	25.3	53.3	13.8	7.6
D 07	100	53	106	113	36.2	40.15	63.6	27.0	6.2	3.2
E 02	100	72	118	113	33.6	39.47	60.0	29.7	6.8	3.5
Average	**100**	**144**	**105**	**101**	**33.6**	**38.39**	**45.8**	**37.7**	**11.2**	**5.3**
Other forms :										
Mo 06	106	8	95	84	31.8	44.88	64.2	24.5	6.5	
Mo 07	104	1	117	123	36.5	42.27	64 5	25.8	5.7	

It is at present too early to state any final opinion regarding resistance to disease and adverse weather, productivity, etc. Norwegian wheat has not many forms. However, judging by what has been accomplished up to date, the author states that it should be possible to isolate and propagate new kinds capable of yielding from 20 to 30 % more than the original varieties (populations).

712 - The Number and Behaviour of the Chromosomes in Certain Wheat Hybrids. — HITOSHI KIHARA, in the *Botanical Magazine*, Vol. XXXV, No. 410, pp. 19-24, 1 pl., fig. 2. Tokio, Feb. 1921.

Results of a series of experiments on the number and behaviour of the chromosomes (1) in the F_2, F_3 and F_4 of the following hybrids:— 1) *Triticum durum* × *T. vulgare;* 2) *T. turgidum* × *T. compactum;* 3) *T. polonicum* × I. Spelta; 4) *T. polonicum* × *T. compactum.*

I. NUMBER OF CHROMOSOMES IN THE F_2, F_3 AND F_4. — In the F_1, the number of diploid chromosomes was 35, whereas, in the F_2, there were individuals with as many as 38; the author, basing his opinion on theoretical considerations, believes that other series, for instance, 36, 37... may be found. In order to settle this question, and for the purpose of investigating the combinations of the paternal and maternal chromosomes the following determinations were made:—

1) *Number of chromosomes present in the equatorial plate during the process of heterotypic division:* In some preparations, it was possible to count the univalent and bivalent chromosomes, and even to distinguish them by their shape, size and position.

2) *Number of isolated univalent chromosomes.*

3) *Number of chromosomes during anaphasis.*

The number of chromosomes in the F_2 has been determined as follows:—

TABLE I. — *No. of chromosomes in the* F_2.

Number of plants (in parentheses)	Number of diploids	Number of chromosomes in the gametes ♂	♀	Isolated Chromosomes
T. turgidum × *T. compactum* . (6)	38	21	17	4
id. . . . (10)	32 (?)	14	18	4
T. polonicum × *T. Spelta* . . . (2)	38	21	17	4
T. durum × *T. vulgare* . . . . (4)	31	14	17	3
T. turgidum × *T. compactum.* . (3)	39	21	18	3
id. . . . . . (4)	42	21	21	0
id. . . . . . (6)	38	21	17	4
T. polonicum. × *T. compactum* . (16)	37	21	16	5

It is a fact worthy of note that in plants with the same number of diploids, the combination formulae of the paternal and maternal chromosomes are identical (See Table II).

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(1) See *R.*, 1919, No. 1116. (*Ed.*)

The number obtained in the case of *T. turgidum* × *T. compactum* (10) is 32; but the number of preparations is not sufficient for an absolutely certain estimate. What is certain, however, is that in some cases 14 bivalent, and 4 univalent, chromosomes have been found.

The presence of one plant which was entirely fertile and had 42 chromosomes deserves special attention.

Table II gives the number of chromosomes in the F_3.

TABLE II. — *Number of Chromosomes in the* F_3.

	Number of chromosomes in the F_2	Number of plant	Number diploids	Number of chromosomes in the gametes		Isolated chromosomes
T. durum × *T. vulgare* . . .	F_2 4 = 31	F_3 4– 1	28	—	—	
		F_3 4– 3	28	—	—	
T. turgidum × *T. compactum*:	F_2 6 (1919) = 38	F_3 6– 8	(38)	21	17	4
		F_3 2– 1	38	21	17	4
		F_3 2– 4	40	21	19	2
		F_3 2– 5	39	21	18	3
T. polonicum × *T. Spelta*	F_2 2 = 38	F_3 2– 6	39	21	18	3
		F_3 2– 8	41	21	20	1
		F_3 2– 9	41	21	20	1
		F_3 2–14	39	21	18	3
		F_3 2–20	39	21	18	3
		F_3 2–21	41	21	20	1
T. polonicum × *T. compactum.*	F_2 1 = ?	F_3 1– 1	41	21	20	1
	F_2 2 = ?	F_3 2– 2	37	21	16	5
	F_2 9 = ?	F_3 9– 1	28	14	14	0
	F_2 11 = ?	F_3 11– 2	40	21	19	2

As regards the F_4, the only data for *T. durum* × *T. vulgarum* refer to the plants F_4 1-7-1 and F_4 2; the respective number of diploids is 42 and 30; the chromosomes in the gametes number, repectively, 21 from both sides, and 21 from one side and 18 from the other; number of isolated chromosomes 0 and 3

II. BEHAVIOUR OF THE CHROMOSOMES DURING THE PROCESSES OF HETEROTYPIC AND HOMOTYPIC DIVISION (POLLEN-MOTHER CELLS). In the hybrids examined, the number of paternal and maternal chromosomes was only equal in the case of tetraploids, or hexaploids (28 and 42), as is clearly shown by reference to Tables I and II.

There is no doubt that the chromosomes from the paternal side, and those from the maternal, arrange themselves in pairs, whereas the supernumerary chromosomes remain isolated.

In the heterotypic, and homotypic, divisions of the nucleus, however, the total number is always equal to the sum of the bivalent chromosomes plus the univalent chromosomes. As in the successive generations, the number of chromosomes increases or decreases (with reference to 35, this being taken as the normal), these hybrids can be divided into 2 groups.

In the equatorial plate of the increasing group, 21 chromosomes are to be counted; in the case of the decreasing group, there are $14 + i$ (i = isolated chromosomes).

The behaviour of the bivalent and univalent chromosomes in the F_2, F_3, and F_4 generations is entirely similar to that of the chromosomes of the F_1.

During the first division, the univalent chromosomes remain outside the equatorial plate, whilst the bivalent chromosomes divide and travel towards the poles. During this time, the univalent chromosomes arrange themselves so as to form the equatorial plate, and themselves also undergo longitudinal division, the two halves moving towards the poles, there to fuse more or less completely with the masses formed by the bivalent chromosomes.

Then the second division immediately takes place, during which the bivalent chromosomes again split longitudinally, whereas the univalent chromosomes divide themselves into two groups which, although belated, travel to the poles of the spindle.

III. Reduction division in the embryo-sac mother cell. — What has so far been said refers to the pollen mother-cells. It would certainly be interesting to know the number of chromosomes present in the egg cell. This it was impossible to determine. The author, however, believes that the mother cells of the embryo-sac divide in the same way as pollen mother cells. The egg cells should have $14 + i$ chromosomes ($i = 0\text{–}7$).

IV. Combination of the chromosomes of both parents. — As has already been said, the normal number of chromosomes in normal pollen grains may be theoretically represented by $14 + i$ (where $i =$ $= 0\text{–}7$). The germ cells would therefore show the following combination: —

$$\left\{\begin{array}{l}14 + 3 = 17\\ 14 + 4 = 18\end{array}\right. \qquad \left\{\begin{array}{l}14 + 2 = 16\\ 14 + 4 = 19\end{array}\right. \text{etc.}$$

provided, naturally, that no decrease in the number of chromosomes had taken place.

In order to estimate the possible combinations that can take place between the chromosome groups of the two parents we have: —

b = the number of bivalent chromosomes 14-21.

i = the number of isolated chromosomes 0-7.

$2b + i$ = the number of the diploid chromosomes.

The author estimates the number and the type of possible combinations for the diploid series at from 28 to 42. The number of combinations varies from 1 to 4. The following are some instances: —

$$\begin{array}{llllll}
 & & b + i = 14 & & & \\
 & & b = 14 & & & \\
 & & i = & & & \\
\mathbf{31} & b - i = 31 & b - i = 17 & b + i = 16 & & \\
 & & b = 14 & b = 15 & & \\
 & & i = 3 & i = 1 & & \\
\mathbf{33} & b + i = & b - i = 19 & b - \quad = 18 & b + i = 17 & \\
 & & b = 14 & b = 15 & b = 16 & \\
 & & i = 5 & i \quad 3 & i = 1 & \\
\mathbf{36} & b - i \quad 36 & b - i = 21 & b + i - 20 & b + i = 19 & b + i \\
 & & b = 15 & b - 16 & & \\
 & & i = 6 & b = 4 & & \\
\end{array}$$

Summarised we have:—

Number of chromosomes	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Number of possible combinations .	1	1	2	2	3	3									

But in reality, all the possible combinations are not formed an examination of the descendants of the F_3 and F_4 would show that the union between gametes with a number of chromosomes above or below, 14 (or 21), gives rise to weakly embryos incapable of development.

In order to obtain normal embryos, one gamete at least (from the paternal or maternal side) must have 14 (or 21) chromosomes

V. PRODUCTIVE AND GERMINATING CAPACITY OF THE SEED OF WHEAT HYBRIDS. — In the groups in which the number of chromosomes increases from generation to generation, the fertility also increases progressively

TABLE III. — *The productivity increases with the increased number of chromosomes.*

	Number of chromosomes	Number of ears	Average number of kernels per ear	Observations
P *T. polonicum*	28	20	29.8	
T. Spelta	42	20	16.9	sown too late
F_1 (*T. polonicum* × *T. Spelta*)	35	2	7.5	
F_2 2 *id.*	38	1	10.0	
F_3 2–20 *id.*	39	4	3.5	weak growth
2–1 *id.*	38	2	9.0	
2–6 *id.*	39	3	13.0	
2–14 *id.*	39	4	15.0	
2–5 *id.*	39	5	15.4	
2–4 *id.*	40	4	18.0	
2–8 *id.*	41	4	22.75	
2–21 *id.*	41	7	26.0	
2–9 *id.*	41	2	30.0	

The number of seeds capable of germinating varies, in the cases investigated, from 42.1 to 100 %, whereas the percentage of completely developed plants is much less, being only from 12 to a maximum of 62.1 %. Some gametic combinations, although cytologically possible, give rise to embryos, and hence to individuals, incapable of normal development.

713 - **Possibility of Eliminating Certain Abnormalities in Maize By Inbreeding.** — LINDSTROM E. W., in *The Journal of Heredity*, Vol. XI, No. 6, pp. 264-277, figs. 3 Washington July, 1920.

It is a significant fact that the great majority of inherited characters known in maize are recessive to the normal type.

The following characters are of this nature: dwarfness, ramosa ear, liguleless leaf — white, greenish-white and yellow seedlings (having no chlrophyll, or very little) — golden, green-striped, japonica, fine-striped, and lineate-leaves (these phenomena are due to irregularities in the development and distribution of the green tissues), being all simple Mendelian recessives to the normal type of maize.

The relation between such recessive characters and the question of inbreeding is very intimate. Continued inbreeding of maize is nearly always followed by a decrease in height, yield and fertility, for since maize is normally a heterozygote, the many negative variations, on account of their recessive nature, generally remain concealed. But when inbreeding progressively augments the possibilities of the union of homozygotes, abnormal types become increasingly probable, and are of frequent occurrence. On the other hand, it might be supposed, that these negative characters having been individualised and isolated in the heterozygous condition by means of selective inbreeding, the remaining plants, since they are relatively free from such abnormalities, would possess only the better characters. This, however, is true only to a very limited extent. It is most likely, that the genetic factors giving rise to the inferior characters are correlated with the favourable ones, being present in the same chromosome; thus in discarding the first, the second are eliminated, and no result is obtained.

We are therefore confronted with the problem of the distribution of the unfavourable factors in the chromosomes. The work analysed gives the results of a series of researches on the distribution of some such factors, especially those concerned with chlorophyll development and distribution. Chlorophyll abnormalities are very prevalent in all types of maize, and vary from a total absence of all pigment (shown in white seedlings), to shades of light-green almost indistinguishable from normal green; in all cases, they decrease the yield to a greater or less extent by diminishing the assimilating capacity of the plant.

At least 8 factors that influence the inheritance of chlorophyll have already been reported:

1) produces white seedlings
2) » greenish-white seedlings
3) » yellow seedlings

4) produces golden plants
5) » green-striped plants
6) » fine-striped plants
7) » lineate plants
8) *Japonica* plants (with greenish-white and greenish-yellow stripes).

In addition, there are 3 new factors still under investigation, making a total of 11 factors governing the formation and expression of chlorophyll in maize. Two of them, l (*yellow* seedlings) and g (*golden* plants) are linked in inheritance.

TABLE I. — *Data relating to the 4 segregated progenies.*

Pedigree No	Purple starchy seed		Purple sugary seed		Colourless starchy seed		Colourless sugary seed	
	Green	White	Green	White	Green	White	Green	White
2955	148	58	56	12	56	16	18	7
2956	74	17	18	6	20	10	6	1
2969	144	48	42	14	65	12	15	6
Total . . .	**366**	**123**	**116**	**32**	**141**	**38**	**39**	**14**
Theoretical . .	367	122	122	41	122	41	41	14
2959	87	18	25	5	48	2	8	0
Total . . .	**453**	**141**	**141**	**37**	**189**	**40**	**47**	**14**
Theoretical .	448	149	149	50	149	50	50	17

RELATION OF WHITE SEEDLINGS TO ALEURONE AND ENDOSPERM FACTORS — A sweet maize with coloured aleurone of the genetic composition ii AA CC Pr Pr R R su su WW, was pollinated by a plant with starchy, colourless endosperm heterozygous for the factor producing white seedlings (ii AA CC Pr Pr r r su su Ww).

The F_1 endosperm was starchy, and of a purple colour in all the grains. The F_1 plants were, however, all of a normal green. Ten of the latter were self-pollinated. The F_2 grains in all showed a distinct 9 : 3 : 3 : 1 ratio of purple starchy — purple sugary — colourless starchy — colourless sugary grains respectively. Among the ten F_2 seedling-progenies, six produced nothing but green seedlings, while four showed a sharp segregation into green and white seedlings.

Progeny 2959 has been segregated and totalled separately because it showed indications of pollen contamination.

The interrelation between the Ww factor pair (governing chlorophyll inheritance), and the Su and su pairs (determining respectively starchy endosperm and sugary endosperm), using the data from the 3 ears, 2955, 2956, 2969, is shown to be as follows:

	Su W	Su w	su W	su w
Observe	507	161	155	46
Calculated	489	163	163	54

The results thus approximate to a 9 . 3 . 3 . 1 ratio very closely The proportion of green seedlings to white is always 3 · 1, both in the starchy group (Su), and the sugary group (su), therefore w and su are not linked in inheritance, but occur in different chromosomes. If the relation between aleurone colour (R = coloured aleurone and r = colourless) and chlorophyll development is considered, similar results are obtained:

	RW	Rw	rW	rw
Observed	482	155	180	52
Calculated	489	163	163	54

There are approximately 75 % green seedlings and 25 % white seedlings in both the coloured aleurone group, and the uncoloured aleurone group thus w and r are not linked, but are transmitted independently.

The same occurs in the case of the factors r and su:

	R Su	R su	r Su	r su
Observed	489	148	179	53
Calculated	489	163	163	54

The preceding facts demonstrate, that the abnormal development of chlorophyll in the white seedlings is not linked with either the character su (sugary endosperm), nor with the character r (colourless aleurone).

RELATION BETWEEN THE FACTORS DETERMINING DWARFNESS AND THOSE DETERMINIG GREENISH-WHITE SEEDLINGS — In maize, dwarfness is a simple Mendelian recessive to normal green. Greenish-white seedlings contain very little chlorophyll at first, but under favourable conditions of light and temperature, they gradually assume a light green colour. It has beenpossible to bring some of these seedlings to maturity.

Several green plants heterozygous to the greenish-white factor (V v), were pollinated by homozygous, green, dwarf plants

The F_1, progeny was all tall and dark green. When self-pollinated, the F_1 plants produced two distinct types: one consisted entirely of green seedlings, the other segregated into green and greenish-white seedlings in the ratio 3 : 1. Both sorts segregated into tall and dwarf individuals, in the ratio 3 : 1,, as is shown by Table II.

TABLE II. — *Seedling progenies of F_2 from self-pollinated normal green plants of F_1 heterozygous for tall dwarf and greenish-white.*

Pedigree N	Tall green	Tall greenish-white	Dwarf green	Greenish white
2862	63	24	27	11
2871	52	21	20	6
2991	57	19	16	5
2992	52	22	20	7
3019	178	52	52	11
Total . .	**402**	**138**	**135**	**40**
Theoretical (9 : 3 : 3 : 1)	402	134	134	45

The characters of dwarfness and greenish white chlorophyll are thus transmitted independently, hence the corresponding genetic factors must be in two distinct chromosomes.

RELATION BETWEEN DWARFNESS AND XANTHOPHYLL PIGMENT. — The seedlings of some variations develop a yellow colour apparently due to the pigments xanthophyll and carotin. This character is recessive to normal green.

Table III gives the data relating to hybrids obtained by the self-pollination of normal green plants heterozygous for height and colour.

TABLE III — *Seedling progenies from self-pollinated normal green plants heterozygous for tall-dwarf and green-yellow seedlings*

Pedigree No	Tall green	Tall yellow	Dwarf green	Dwarf yellow
3006	180	72	87	
3011	32	7	11	
Total . . .	**212**	**79**	**98**	**24**
Theoretical (9 : 3 : 3 : 1).	232	78	78	26
Theoretical on 1 : 1.4 linkage . .	225	85	85	18

The figures obtained do not agree very closely with the 9 : 3 : 3 : 1 ratio, and seem to correspond better with what would be expected in the case of linkage. The latter, giving a gametic ratio of 1 : 1.4 would account for the number of tall-yellow and dwarf-green gametes being larger than that of the tall-green and dwarf-yellow gametes. (See Table III).

CONCLUSIONS. — The presence of a very large number of genetic factors having a negative influence upon the development of chlorophyll is thus clearly shown in the chief commercial varieties of maize, and as they lessen the assimilating capacity of the leaves, the productivity of the plant is decreased. On the other hand, as has been demonstrated by the facts set forth above, the genetic factors governing these abnormalities in the development and distribution of chlorophyll are distributed in different chromosomes. Therefore, the elimination of these negative determinants would inevitably remove the positive characters of which the factors were present in the same chromosome. To succeed in a system of maize-inbreeding then, it is essential to begin with the best material available which is as free as possible from abnormalities and defects. It is probable that the inbreeding of such stock might be carried out quickly and therefore with very little loss of height, yield, or fertility, and would at the same time improve the uniformity of the type.

714 - **Selected August Maize from Piacenza.** — ZAGO F., in *L'Italia agricola*, Year 58, No. 5, pp. 145-146, 1 plate. Piacenza, May 15, 1921.

The author applied to the selection of August maize from Piacenza the method of HOPKINS (Firstly, selection in the field of the finest ears on the most vigorous plants; secondly, growing in separate plots, the grain of each ear; thirdly repeated selection from the selected produce so as to fix the characters) and he describes the good results which he obtained.

August maize from Piacenza is a good variety, ripening early, medium height, regular ears, large grains, of a fine orange yellow colour. In 5 years of selection the author has obtained a greater uniformity of plants, regular ears and an increased production

715 - **Cross between Peas with Coloured Pods and Peas with Green Pods.** — DE VILMORIN, J., in the *Comptes rendus des Seances de l'Academie des Sciences*, Vol. 172, No 13, pp. 815-817. Paris, March 1921.

There are varieties of coloured flowered peas whose pods show a coloration that is more or less violet, sometimes quite violet: such a coloration is *dominant* over the normal green. The character "violet pod" may also superimpose itself on the character "yellow pod", and produces a very pretty fine bright red.

In the results of numerous crossings made at Verrières, plants with white flowers were found, which showed on the quite young green pods slight traces of violet, or else, in the case of plants with yellow pods, slight traces of red.

The hypothesis is, therefore, that the violet tint is inherent also in the white flowered plants but that it requires, in order to be completely manifest, the presence of the factor of pigmentation, derived from plants with coloured flowers.

If this supposition is correct, by crossing white flowered plants with pods slightly shaded with pink, with coloured flowered plants with green pods, a hybrid with violet pods ought to be obtained in the F_1. This is exactly what happened. In 1917 a cross was made between a white flowered pea with pink shaded pods and *Pisum elatius* which has a purple flower but a green pod; 2 plants were obtained in the F_1 generation, both with violet pods. Similar results were obtained in another cross made in the same year, using pollen from a pea with pink-coloured flowers and green pods.

Owing to the diversity of characters among the plants used for crossing, the F_2 generation shows great variability both in the colour of the pods (greens, violets or purples, yellow or red-violet on yellow) and in the colour of the flowers (whites or purples, plus a few plants with pink flowers derived from the second crossing).

Great differences were also noted in the colour of the ripe seed, which might be mottled garnet or plain garnet (the *Pisum elatius*, from which the pollen was taken, has mottled seeds) or else plain white or mottled white with the white flowered plants. That was for the first crossing; on the other hand in the second crossing with the coloured flower specimens, the seeds had a red tint that was plain or mottled.

These characters are distributed numerically in proportions manifestly Mendelian which, however, have not yet been established with accuracy owing to the limited number of F_2 plants.

716 – ***Butiarecastrum Nabonnandi*, a New Palm Obtained by Crossing *Butia capitata* v. *pulposa* Beccari with *Arecastrum Romanzoffianum australe* Beccari.** — ROBERTSON PROSCHOWSKI, A., in the *Revue Horticol*, Year 93, No. 17, pp. 260-261, fig. 1. Paris, May, 1921.

Among the exotics which stood the hard frosts of December 16-17, 1920 on the Côte d'Azur best, may be mentioned a hybrid palm obtained about 30 years ago by P. NABONNAND, Manager of the horticultural establishment of Cannes-Eden (Golfe Juan, Alpes Maritimes) by fertilising *Butia* (*Cocos*) *capitata* v *pulposa* Beccari with the pollen of *Arecastrum Romanzoffianum australe* Beccari (*Cocos flexuosa* Hort.)

The author proposes to name this hybrid *Butiarecastrum Nabonnandi*; it is clearly distinguished from its two parents by the growth of its leaves and by its appearance, and resembles *Howea*, from which however it is distinguished by a thicker trunk, equal to that of the mother plant *Butia capitata*. The trunk is smooth and without rings (like its parent *Arecastrum*) which adds to its ornamental character, since the cicatrices of the fallen leaves are much more crowded and close together.

The specimen described by the author was about 9 m. high; the leaves, which are 5 m. long, are at first erect and then curved back at the end; there are about 30 of them; as soon as they dry, instead of remaining to rot on the tree (as happens on *Butia*), they become detached spontaneously, from the trunk. The sword-shaped leaflets, 80 cm. long and 4 to 5 cm. broad, are about 1 cm. apart.

The non-thorny petiole (character inherited from its male parent) is, at the point to insertion, of a fine mahogany red, which passes into a greenish brown to become a fine olive green up to the tip. The spadix, about 2 m. long and 1 m. broad is fairly branching. According to NABONNAND, the fruits are, according to the specimens, sometimes globular, sometimes slightly ovoid, rather resembling those of *Arecastrum;* their colour is yellow ochre and they have fibrous flesh. The growth of this hybrid is at least 3 times more rapid than that of the mother plant *Butia capitata* and it is at least as hardy; some young specimens stood as much as —10° C. without injury.

It is therefore a plant of rare ornamental value, whose very great hardiness would permit of its being planted in countries with climates less mild than that of the Côte d'Azur

717 – **Heating of Seeds as an Aid to Selection.** — See No 707 of this *Review*.

718 – **Results of Cultivating Selected "Todaro" Wheats, in the Molise, Italy.** — IOSA, G., in *L'Italia agricola*, Year 58, No. 3, pp. 65-72, figs 5. Piacenza, March 15, 1921

The TODARO (1) wheats, that is to say the pure kinds bred by this scientist on the estate of the "Società bolognese produttori sementi," near Bologna, are suitable to the climate and rich cool soils of Northern Italy and to those of Central Italy when well cultivated; but this does not exclude the possibility of their being successfully grown on the plateaux, in the zone of the hills of medium elevation and on the even slopes throughout the southern Apennines. Some kinds even, such as "Carosella 91," originally from that region cannot but find favourable conditions there.

Experiments made in 1920 in the Molise have demonstrated the possibility of obtaining from TODARO wheats higher yields than those given by the local kinds of wheat. These experiments were carried out at two centres:— 1) at Campobasso, in the zone of the central hills of the Province, at altitudes of from 600 to 700 m.; on mould or somewhat clayey soils, rich and well tilled; the wheat succeeded maize or clover; 2) at Boiano, on a plateau at an altitude of 500 m., on rather compact, cool, deep soils; wheat sown after maize (the head of the rotation), on green manuring with *Galega* or after clover

The most typical kinds for given exigencies and aptitudes were chosen for experiment such as:—

Rieti 1. — Glumes very light yellow; spikelets compact. Very early and strong growing. Not being sufficiently resistant to lodging and rust, it suits hilly land where these faults are less important. As it sheds its grain readily the harvesting has to be carried out quickly.

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(1) Cf. F. TODARO, Lavori di selezione del frumento nel Bolognese Bologna, 1910 F. TODARO, I grani selezionati della Società Bolognese produttori sementi. Bologna, 1914.

F. TODARO, Il perfezionamento agrario delle piante. Relazione al premio quadriennale Cesare Zucchini. Bologna, 1917

F. TODARO, Selezione di cereali. Frumenti, avene, orzi selezionati. *L'Italia agricola*, No. 5; May 15, 1919; reviewed in *R.*, July-Sept. 1919, No 854. (*Ed*)

Rieti 11. — Ears better developed and less flat than the preceeding variety; with a few supernumerary spikelets. Vegetation period longer than in the case of other kinds of the same type. Remarkably strong growth. Poor resistance to lodging, none to shedding grain, but very strong to rust. Suitable for good hill soils and for flat land not too rich in nitrogenous matter.

Cologne 12. — High productivity; early; very resistant to rust. Sporadically subject to total or partial failure of the basilary spikelets; inclined to shed grain Specially suitable for localities subject to rust, such as the shut-in plateaux of the Apennines.

Results of experimental cultivation of wheat in the Molise.
(Agricultural year 1919-1920).

Communes		Yield in kg. of grain per hectare
Campobasso	Carosella 91	1815
	Noè reproduced	1470
Campobasso	Carosella 91	1000
	Carosella local	750
Campobasso	Carosella 91	1700
	Cignarellone	1560
	Carosella local	1210
Campobasso	Carosella 91	2050
	Cignarellone	2530
Boiano	Rieti	1800
Boiano	Rieti 11	2100
Boiano	Cologna 12	1613
Boiano	Gentil rosso semi-bearded 48	1125
	Solina local	945
Boiano	Rieti 1	1178
	Rieti 11	1335
	Cologna 12	1364
	Gentil rosso semi-bearded 48	1525
	Caccavone	1232
	Quagliarello	1075
	Re	1553
Boiano	Rieti 1	1360
	Rieti 11	1160
	Cologna 12	1050
	Gentil rosso semi-bearded 48	1780
	Fucense reproduced	1660
	Solina local	450
Boiano	Rieti 1	1200
	Rieti 11	1280
	Cologna 12	1250
	Gentil rosso semi-bearded 48	1400
	Solina local	725

"Gentil rosso", semi-bearded 48. — Ear slightly bearded on the spikelets of the upper third or half and beardless in the lower part. Very productive; resistant to lodging; sufficiently resistant to rust. Suitable for good hill soils that are well tilled, and for richer soils in the plains.

Carosella 91. — The "Carosella" wheat originated in the Molise, where it has 2 types of ears:— 1) With spikelets quite beardless; 2) with spikelets the upper third or quarter of which is furnished with more or less rudimentary awns. "Carosella 91" resembles the second type, the extremity of the ear being bearded. It is one of the best varieties selected by TODARO. Tall but strong stalks; leaves with a characteristic bloom; ears long and rich, very resistant to lodging and fairly resistant to rust, high productive (slightly inclined to shed its grain). It is suitable for fertile soils in the plains and medium hills.

The results of the experiments are summarised in the foregoing Table. With the exception of "Cignarellone," which by its productivity and resistance to rust has equalled the TODARO varieties and sometimes has even surpassed them, all the other local wheats have had a lower unit production (from 1.4 to 13.3 quintals per hectare). The variety which has shown itself the most constantly productive, and which is really very valuable, is "Carosella 91" which is suitable for hills of an altitude of between 400 and 700 m in the Southern Apennines.

"Gentil rosso" 48 and wheats of the "Reatino" and "Colognese" type have behaved in a rather variable manner but they have yielded, in certain cases, fairly large crops and they have proved, in short, good wheats for the plateaux of the Apennines and for cool zones in hill country in the South.

719 - **Sweet Potato. — I. Cultivation along the Southern Coast Belt South Africa; — II. Chemical Composition and Comparative Analyses of Tubers.** — JURITZ, C I., (Agricultural Research Chemist, Capetown), in *Journal of the Department of Agriculture, South Africa*, Vol II, No. 3, pp. 229-239, and No. 4, pp 310-352 Pretoria, March-April 1921.

I. — In connection with the production of alcohol on a large scale, in order to serve as a basis for liquid fuel, attention has lately been drawn to the possibilities of utilising the sweet potato (1). Although at present the extent of this cultivation adequately suffices to meet the demand along the southern Coast belt of the Cape Province which is restricted to the employment of the tuber as human and stock food, the author considers that the area indicated can produce sweet potatoes to a far greater extent to meet the coming demand.

The most favourable conditions for cultivation are bright days and warm nights, a medium rainfall, which is available during a growing period of from 4 to 6 months annually. Although the crop adapts itself to other soil conditions (2), it attains perfection in light sandy loam with a somewhat clayey but well drained sub-soil, (standing water around the developing tubers is most harmful). In the Division of George the most abundant producing area, the flourishing farm of ROBERTSON at Little Brak River is taken as an example and the methods of cultivation described in detail. The varieties grown here are the common 6 months, the red-skinned 3 months, the yellow skinned 3 months and the British East African white-skinned. The first is the most in demand on account of its keeping qualities. The sweetest of the four is the yellow, the next the red and the least, the white.

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(1) See No. 764 of this Review. (*Ed.*)

(2) Behaviour of Sweet Potatoes in the Ground See *R* Aug 1918, No 851. (*Ed.*)

The author describes the two methods of propagation by tuber slips and cuttings from the runners; the latter is the method principally adopted in South Africa. A comparison is made with the propagation methods in the United States and in Queensland. In the former, the sprouted slips are employed in the north for the main crop, while the runners are used only to provide the seed tubers for the following season; south of Virginia the runners provide the main crop.

Although irrigation is oten practised for sweet potatoes in America, ROBERTSON does not recommend this proceeding unless absolutely necessary. For open crumbly soils he advises the planting of cuttings in a damp soil, and for compact soil, irrigation should not follow but precede planting; sandy soils may however, be irrigated after the cuttings are in.

On the farm under consideration rotation is found distinctly advantageous, including in the rotation a leguminous crop.

It is evident that sweet potatoes need potash and in the Northern States U. S. a successful fertiliser used (1) to be recommended, containing 4 % nitrogen; 8 % phosphoric oxide, and 8 to 10 % potash. The potash requirements are evidenced by the analyses of the ash (KÖNIG) which shows a potash content of 50.31 %, and 46.15 % (ROBERTSON).

Chemical composition. — The average composition of the sweet potato according to a series of analyses of tubers from different countries is shown as follows:—

Principle constituents	Average for 12 series (1)	United States (2)	England (3)	Japan (4)	Azores (5)	Malaga (6)
Water	71.86 %	73.39 %	70.98 %	76.19 %	86.45 %	69.10 %
Protein	1.00	1.28	0.92	2.81	0.39	1.20
Fat	0.20	0.28	0.49	0 12		
Nitrogen free extract	25.05	—	—			
Gum, etc.	—	1.08	2.39	3.11	-----	27.06
Sugar	—	6.86	2.69			
Starch	—	15.06	20.26	14.80		
Fibre	1.03	0.98	1.20	1.79	0.49	1.32
Ash	0.86	1.07	1.07	1.17	0.55	1.32

(1) KÖNIG. — (2) JOHNSON S. W., *Connecticut Agricultural Experiment Station.* — (3) NEUBAUER and OECONOMIDES (Average of 3 analyses). — (4) NAGAI and MURAI. — (5) and (6) CORENVINDER.

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(1) See *R.* April 1918, No. 416. (*Ed.*)

[719]

Samples of each class of sweet potato grown at Little Brak S.Africa were collected for analysis. The percentage results are shewn in Table II

Yield. — In the Union of South Africa, according to the 1918 Agricultural Census, the area under sweet potatoes in the 4 provinces amounted to 20 392 acres. The total production amounted to 69 141 150 lb. (3390 lb. per acre), the Cape Province heading the list with 12 162 acres under cultivation. However, as much as 16 300 lb. per acre has since been reported at Little Brak, where the soil is black alluvium and had been irrigated before ploughing: It was manured with $^1/_2$ ton "potato fertiliser" with the following percentage composition: phosphoric oxide (total) 8.0, (citric soluble 7.5); nitrogen 3.5, potash 6 0 and lime 16 0. The season was dry and the crops had received no subsequent water other than occasional showers. This may be taken as a sample of the possibilities as regards yield.

The author summarises the comparative yields in the United States, and also describes investigations begun there for the purpose of determining the identity of different varieties of sweet potatoes and for developing the most suitable method of utilising the plant as a stock food in regions where it can be cheaply produced (1). A general investigation was carried on at the same time of dry rot, stem rot, and other diseases of the sweet potato, and the remedial measures were studied and suitable treatment recommended.

Reference is also made to the experiments carried out at Barbados (HALL and BOVELL, *West Indian Bulletin*, Vol. V, No. 1, pp. 44-52, 1904) for the purpose of ascertaining the best varieties for cultivation. Twenty-eight varieties were planted of which White Gilkes (6 months) gave the best returns, the next 3 in order being Hurley, Minuet and Vincelonian.

With regard to storage, a preliminary sweating process is strongly recommended — 2 weeks' storage in a well-ventilated cellar, at a dry temperature between 80° and 90° F. The temperature is allowed to fall later to about 65° F, and is maintained at this point.

A common method also employed is in making about 20 to 30 bus. into a pile and covering with straw If the temperature is maintained at 40°F, the tubers will undergo sweating, as desired. This may be followed by covering the pile with earth, gradually more and more thickly up to a thickness of 4-6 in.

A local method of storage practised in South Africa is to dig a trench, fill it with tubers piling them into a ridge 3 ft. above ground and covering with a water shed roof of sods, leaving an air-hole.

To give an idea of the cost of production per acre, the author has collected statistics from the United States as applicable to cultivation in South Africa, and estimates the total cost at £16.10s 2 d. excluding hauling to market. This will however vary according to the district. On the other hand the produce of an acre has often realised as much as £2 to £30.

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(1) See *R* June 1917, No 543. (*Ed*)

TABLE II. — *Analyses of sweet potatoes cultivated in South Africa*

		Entire tuber				Outer layer				Central core			
		Common 6-months	Red skinned 3-months	Yellow skinned 3-months	Br. E African white skinned	Common 6-months	Red 3-months	Yellow 3-months	White Br E African	Common 6-months	Red 3-months	Yellow 3-months	White Br E African
Original weight of tuber	gm	307	110	530	470	360	710	670	520	360	710	670	520
Water	%	70 55	80.02	77 06	70 61	67 08	82.41	73.72	73.06	68.72	82 49	78.06	75 91
Protein (N × 6.25)	»	0.94	—	0 68	1.34	0 97	0 65	0.71	1 18	0 77	0.59	0.47	0 89
Fat	»	0.63	—	0.21	0.16	0.40	0.42	0 20	0.33	0.54	0.47	0 15	0 27
Nitrogen free extract	»	26.22	—	20 42	25 54	29.93	14.66	23.96	23 83	28.58	14.97	19.91	21 73
Fibre	»	0.61	—	0.80	0.77	0.61	0.68	0 59	0.62	0.47	0.56	0.40	0 45
Ash	»	1.05	—	0.83	1.28	1.01	1.18	0.82	0.98	0.92	0.92	0.41	0 75
Sugars (reducing)	»	4.47	2.68	0.46	5.24	—	—	—	—	—	—	—	—
Sugars (non-reducing)	»	1 59	2 92	2.69	0.81	—	—	—	—	—	—	—	—
Specific gravity of tuber	»	1.08	1.04	0.90	1.05	—	—	—	—	—	—	—	—

In connection with the cost of production in Cape Province, ROBERTSON has supplied the following information :— Excluding ploughing and harrowing, the cost of cutting shoots, dividing them into required lengths, making water furrows, holes, planting, closing up, irrigating after ploughing, is approximately 18/- per acre (using boys, natives, women and other cheap labour). For adequate cultivation, the crop requires horse hoeing 3 times, hand hoeing twice, irrigation once, amounting to 24 - per acre. — Digging and bagging £4 per acre so that here the total cost approximates to £6.12 s. excluding costs of bags, carting, cuttings and manure.

720 – **Feeding Value of the Pods and Seeds of *Prosopis Stephaniana*.** — *Bulletin of the Imperial Institute*, Vol. XVIII, No 4, pp. 478-479 London, Oct.-Dec 1920.

Pods and seeds of the leguminous shrub, *Prosobis Stephaniana* were forwarded to the Imperial Institute from Cyprus with a view to ascertaining their value as feeding stuffs. This species is indigenous to Cyprus, but occurs also in the Punjab, Afghanistan and the Caucasus

The analysis gave the following percentage results: for whole pods, pod cases only, and seeds only, respectively :— moisture 10.1, 10.4, 9.5; crude proteins, 13.0, 10.4, 18.2; fat 2.6, 2.5, 2.8, carbohydrates (by difference) 56.8, 56.2, 58.0; fibre, 14.1, 17.0, 8.4; ash, 3.4, 3,5 3.1. The nutrient ratio was 1 : 4.8, 1 : 60, 1 : 3.5, and the food units 96, 89, 111. No alkaloids or cyano-genetic glucosides were detected in the samples.

The pods (freed from seeds) contained 3.8 % of sugar (calculated as dextrose), so that they differ materially in this respect from carob pods which contain from 30 to 50 % of sugar. No tannin was present. The value as feeding stuff is somewhat reduced by the highly fibrous nature of the pods, and the hardness of the seed coat .The pods of the allied species *P. juliflora* which contain a large percentage of sugar (25 to 28 %) are stated to be used as a feeding stuff, and trials might therefore be made with *P Stephaniana* pods and seeds.

721 – **Cotton Growing in the Belgian Congo** (1). — LEPLAE, E (Directeur général de l'Agriculture au Ministère des Colonies), in *Bulletin of the Imperial Institute*, Vol. XVIII, No 3, pp 352-402, figs 2, pl 2, London, July-Sept. 1920, and *Bulletin Agricole du Congo Belge*, Vol XI, Nos 1-2, pp. 80-105, pl 1. Brussels, June, 1920

It seems likely that Central Africa will some day supply the European markets with a much larger and better cotton crop than was hitherto expected. The Uganda Protectorate and Nyasaland are already among the cotton producing countries, their soils and climates having proved quite suitable to the growing of a very useful type of cotton. The author shows that conditions favourable to cotton cultivation extend also to the centre of Africa and cover a large tract of country Transport facilities by river and rail throughout the Belgian Congo have been considerably improved during the war, and several cotton producing districts are now shipping a few hundred tons of cotton to Antwerp and the cotton mills of Belgium.

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(1) See *R.* Jan 1914, No 3. (*Ed*)

Experiments were commenced six years ago in the Lower Congo District and were gradually extended further north. They are at present in progress at Maniéma and at Sankuru. Notwithstanding the adverse meteorological conditions, several attempts were made under the Congo Free State Government to introduce cotton amongst the crops grown by settlers or natives. American, Egyptian and Peruvian cotton seed was tried in the State Agricultural Station, but gave no definite practical results.

In 1909 a new and more thorough experiment in cotton cultivation was however conducted under the superintendence of J. **Claessons**, Agricultural Engineer, who formerly owned a cotton farm in Oklahoma (U. S. A.). From 1913 onwards, the encouraging results here reported are due to the untiring activity of the American expert E. **Fisher**.

Cotton trials were first conducted at Kitobala (Lower Congo), 1913-15, at Nyangwe (Maniéma) and Stanleyville (Upper Congo) 1914-16, at Babadi (Loukala) near Lusambo, Sankuru (1916-17).

Lower Congo. — About 50 acres of cotton were planted in 1913, and several quite satisfactory results were obtained. But the unreliability of the rainfall was proved in a decisive manner, as the rains were very irregular and scanty, and large tracts of cotton in the unirrigated fields were a total loss. Of the various varieties tried at Kitobola, Triumph long staple and Simpkins short staple gave the biggest returns.

Upper Congo. — The rainfall at Nyangwe (Maniéma) is regular, with about 52 cm. of rain, and only 2 months of dry weather. The first planting of cotton in 1914 covered 55 acres, the same varieties being grown as were planted in 1913 at Kitobola. Nearly all the land consists of a sandy loam with a clay subsoil, easy to plough after the first time, and also easy to cultivate. In 1915 an area of 135 acres was planted and the first really normal trials undertaken. On account of the seasonable weather no trouble was experienced in the 1915-16 season in keeping the fields clean and the plants in proper growing condition. The proper distance to plant depends largely on the quality of the soil and the varieties to be planted. The average for most of the American varieties on lands of average fertility is about 1.20 m. between the rows and from 35 to 50 cm., in the rows, except for short stapled varieties such as Simpkins which is of small growth, and is planted 1 m × 30 to 35 cm. Five seeds per group is sufficient, planted at a depth of from 25 to 44 mm.

The best time for planting long-stapled varieties seems to be December, and for short-stapled cottons, January. Simpkins can be left as late as February 15. Native cottons are planted in October. Three weeks after planting, the seeds grew so rapidly that they were ready to be thinned out, and the land was cultivated. A month later and this was repeated and the cotton was hilled.

The gathering of the cotton began in 1916 in April, but that is unusually early compared with the normal possibilities.

The author gives full details of the varieties grown, and their respective yields. These include Nyasaland, Allen Long Staple, Sunflower Long

Staple, Simpkins Early Prolific, Triumph Big Boll, Peruvian Red Short and White Long Staples, Greenseed and Blackseed, Zeidabi (long stapled), Sunbeam (American long stapled), Sakellaridis and Abassi (Egyptian).

Amongst these, it was evident that Simpkins proved the best adapted for native cultivation, as it is quick growing, and quick maturing, and one of the most resistant cottons to drought, insect attacks and fungoid diseases and general unfavourable weather conditions. It is fully developed 3 to 3 ½ months after being planted, and ripens within the following 2 months. The author considers that this is the only variety which would have any chance of success near the Equator, where the dry season is very short. The sole disavantage is the shortness of its fibre, which, however, is very strong.

The Triumph Big Boll has three superior advantages namely: 1) it yields well; 2) it requires far fewer bolls to make 1 kilo. of cotton than the other varieties and owing to the large size of the bolls, a much greater quantity of seed-cotton can be gathered daily, thus reducing the cost of picking etc., but it requires a far longer time (4 months after full development) than Simpkins to ripen and the weight of the bolls causes the limbs to bend to the ground and accumulate dirt, and makes the plant subject to attacks of insects and rodents. In a locality with well-defined and lengthy rainy and dry seasons, this variety is recommended, as the quality of the cotton and the staple is excellent, and the fact that the variety is less resistant to drought and disease than Simpkins can be dealt with effectively under such circumstances.

The Egyptian cottons have been an almost complete failure. In the absence of irrigation and more suitable climate, they will always give disappointing results.

Central Congo. — Two cotton growing districts have been established here. 1) The Maniéma district around Kassongo. This district will be able to ship cotton through Stanleyville and the West Coast, or through Tanganyika-Udjidji-Dar-es-salam and the East Coast; 2) The Kasai-Sankuri-Katanga districts, with the country surrounding Lusambo, and Kabinda (Eastern Katanga). This second district has extensive savannah lands, and is thickly populated, cattle rearing is generally possible and roads can be easily constructed. Cotton will have to be shipped to Stanleyville and Matadi

Northern Congo. — The most interesting district for cotton growing in the north is the Uelle, where the rainy season starts in April and lasts until November; the dry season extends from then onwards till April, with a short period of rain in February. Trials were started in the Uelle and Ituri districts in 1919 by the Vice-Governor, Colonel de MEULEMEESTER. Large fields were planted by the natives of the Kilo-Mahagi region and some 1500 acres were covered. Samples of this cotton have now been received in Belgium, and are of good quality.

GENERAL. — The area of land planted in the Congo by the natives was 1125 acres in 1916; 2000 acres in 1917, about 2500 acres in 1918;

and 2000 acres in 1919 (the reduction in this case being due to an epidemic amongst the natives), and 5000 acres in 1920.

The average yield of seed cotton is 528 to 616 lb. per acre. In fertile fields, however, the yield rises to 880 to 1320 lb. per acre, without any application of manure.

The average yield of lint is somewhat above 176 lb. per acre. To obtain 1 ton of lint, therefore, requires 12 ½ acres. The average yield of lint in the United States being 200 lb. per acre, usually, on manured land, the yield of 176 lb. for the Belgian Congo, must be regarded as satisfactory.

Although direct cultivation of cotton by white settlers is not excluded or hindered by the law in any way, it seems that the industry will be carried on principally by the natives, who can produce seed-cotton much more cheaply than a settler.

722 - **Cotton Prospects in the Philippines.** — ESPINO, R. B. (College of Agriculture, Los Baños) in *The Philippine Agricultural Review*, Vol. XIII, No. 3, pp. 186-209. Manila, 1920.

The author's aim is to give the planters and prospective planters in the Philippines a guide in the selection of species or varieties and in the cultural phases of the cotton growing, in consideration of the great possibilities of growing it successfully in this country in the future.

A resumé is given of the various varieties of commercial cotton derived from the 7 species of *Gossypium* indigenous in different parts of the world, and the statistical distribution as regards acreage under cultivation, bales of cotton produced, exports and imports. Stress is laid on the last mentioned, namely the imports, as this has a direct bearing on cotton prospects in the Philippines. Japan imports a large quantity of raw cotton (1 ½ million bales) and has up till now imported the larger part from the United States (which produces about 58 % of the world's cotton), but, considering the geographical situation of Japan, in connection with the Philippines, there are obviously opportunities, in store for the latter where the soil and climate are exceedingly well adapted to cotton and labour is plentiful.

Up till now cultivation has been almost entirely confined to the provinces in Luzon. Some 3053 hectares in the Ilocos provinces, were devoted to cotton in 1902, yielding 68.2 % of the 1 322 118 kg. of the entire production of the Philippines. In addition to this 239 ha. in Batangas, and 266 ha in La Unión were reported to have produced in 1902, 21 266 and 362 464 kg. of cotton, respectively. This gives ample evidence of the fact that pest-resistant varieties already exist in these areas, in spite of the objection raised that the prevalence of insect pests is the chief drawback to cotton planting in this country

REVIEW OF FIELD TEST. – In connection with the acclimatisation phase of the problem, several cultures were started in 1920 at the College of Agriculture, Los Baños, in which varieties or species of native and foreign cotton were grown simultaneously. These cultures will probably be repeated each year until a time is reached when the yield can no longer be increased by acclimatisation, or when one or more varieties shall have been found to be the most promising.

Investigations concerning the best months for planting native varieties, and the study and control of insect pests are to be made

In 1911, the Bureau of Agriculture reported the results of preliminary tests. Certain native types of cotton were found to exhibit such encouraging results that it was considered necessary to conduct a more detailed and systematic investigation Native varieties were compared in the field with some American types. The results obtained showed that the varieties Toquillo, Gapaz Kinachila and Gapaz Sangley or Candava, made a luxuriant growth, much superior to the American types, but matured somewhat later than the latter varieties. As regards yield, the Toquillo and Kinachila were much inferior to the American cottons but the Sangley compared favourably with the same. The native varieties were practically free from the attacks by the weevil, but the American types were, however, very badly infested.

From the 1912 field work, it has been concluded :— 1) That the cultivation of American and other foreign species on a large scale from imported seed at least in the vicinity of La Carlota is an unsafe investment ; 2) that the native species Torquillo and Sangley are the only two that can be recommended for cultivation on a large scale ; 3) the seed should be sown so as to bring the plants to maturity not later than the middle of the dry season. After that period, heavy rains are liable to set in with such frequency as to impair the quality and quantity of the floss.

The author reviews, in general, the history of cotton, the economic importance, the classification of cotton fibre, climatic environment in various countries, preparation of the land, cultural operations, diseases and pests.

The author considers that the Philippine Government should thoroughly investigate the relative suitability to varieties of the varying climate and soil conditions, etc. owing to the evident possibilities in store for this country in connection with cotton cultivation.

723 - **The Oil of South African Marcola Nuts (*Sclerocarya Caffra*).** — *Bulletin of the Imperial Institute*, Vol XVIII, No 4, pp 181-183, London, Oct-Dec. 1920.

The marcola nut is the product of *Sclerocarya Caffra* Sond, a small tree 20-30 ft. in height, belonging to the Natural Order Anacardiaceae. The tree is found only in Natal and the Transvaal, being very plentiful in the Bush Veld, and the Low Veld. The fruit is a drupe and when ripe is about the size of a small hen's egg, and of a yellow or greenish yellow colour. The thin pulp which surrounds the nut has a flavour similar to that of the mango, but is much more acid.

About 1 ¼ cwt of the nuts, collected in the Pretoria District were recently forwarded to the Imperial Institute for analysis in order to ascertain whether they would be of commercial value. The nuts were of irregular shape, averaging 5 gm. in weight and containing 1 to 3 kernels.

The shell which was very tough and fibrous, was covered with a thin layer of dried pulp of a pinkish brown tint. The nuts consisted on an average of 90 % shell and only 10 % kernel.

The kernels contained 5 % moisture and yielded 56.2 % of oil, equivalent to a yield of 59.2 % from the dry kernels. The oil, which was clear, limpid and pale yellowish-brown in colour was examined with the following results in comparison with corresponding figures recorded for a sample of maroola oil from the Northern Transvaal: specific gravity at 15° 0.9167 compared with 0.9153; melting point of fatty acids 25.0° C to 24.3° C, acid value 3.7 to 3.2; saponification value 193.5; iodine value 76.6 % to 72.9 %; soluble volatile acids 0.1; insoluble volatile acids 0.45; unsaponifiable matter 0.6 % to 0.93 %.

The kernels of these maroola nuts give a good yield of oil of the "non-drying" type which would be suitable for soap manufacture and possibly for edible use. In view, however, of the difficulty of cracking the nuts, and separating the kernels, it seems very unlikely that the nuts could profitably be used as a source of oil.

724 - **The Rubber Plant of the Mexican Deserts** (1). — Forvin, V., in *La Nature*, No. 2248, pp. 148-149, figs. 3. Paris, March 5, 1921.

The "guayule" was known to the natives of Mexico long before the Spanish conquest. They extracted the rubber by mastication and used it for making balls for games. But the shrub did not attract scientific attention until 1852, when an American botanist, Dr. J. M. Bigelow, attached to a Commission charged with settling the boundaries of the new frontiers between the United States and Mexico, discovered it near Escondido Creek (Texas).

It was described in 1850, by Prof. Asa Gray, of Harvard University under the name *Parthenium argentatum*. Its common name in Aztec means "rubber tree."

For a long time it was considered of no value except as a good fuel. The Mexican miners cleared thousands of hectares of it for smelting, and the great industrial value of guayule was only suspected about 1876 when a block of rubber extracted from this shrub was shown at the Philadelphia Exhibition.

In 1888 the first attempt at exploitation was made by sending 50 tons of bark to New York, and 18 % of rubber of excellent quality was obtained. In the same year samples were sent to England and Germany, but the German chemists declared that guayule would never have any commercial value.

However, an American company installed an experimental laboratory at San-Luis-de-Potosi in 1901, and obtained such promising results that the first factory was built at Jimulco, which commenced to produce crude rubber on an industrial scale in 1905. By the end of 1910 the capital engaged in the new industry totalled 65 million gold dollars.

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(1) See *R.*, March, 1919, No. 320. (*Ed.*)

The habitat of the guayule is fairly clearly defined. The plant appears to have originated in the desert of Chihuahua, which forms the northern portion of the Mexican central plateau, and has spread over all the neighbouring arid regions situated at altitudes of from 1000 to 2000 m. It is found in the south of Arizona and of New Mexico. Its habitat covers 290 000 sq. km. of which 70 000 sq. km. can be worked industrially. The shrub is not more than 1 m. high. It differs from most rubber-producing plants by the fact that the rubber is contained in certain kinds of cells instead of being in the latex. F. E. LLOYD, professor of plant physiology at the Polytechnic Institute of Alabama, who has devoted years of study to guayule has not yet been able to discover what physiological rôle the secretions of rubber play in the life and growth of the plant. He has, however, proved that these secretions are less abundant in summer and this may provide a key to the mystery.

Now that rubber plantations are reducing production to avert a fall in prices (1), it may seem strange that the existance of a new source of the product should be noticed. Guayule, however, has advantages which should merit the attention of several Colonies. It thrives on arid and desert lands where any other crop would fail, subject to the condition that the soil contains a certain amount of lime, and it will grow on high plateaux where rain is infrequent and small in amount. It withstands considerable differences of temperature and even braves the neighbourhood of freezing point. Lastly, in spite of its small yield in rubber, which is an average of 12 % of the total weight of the shrub, it can be profitably worked throughout the year.

Extraction is not complicated, and the factories have copied the native process, which consists in chewing the bark and roots. After washing in plenty of water, the shrub is crushed between rollers under a fine spray. The mass obtained is sent through turbines which separate the rubber. The crude product is sent to the refineries.

In 1914, several laboratories, both in Mexico and the United States, endeavoured to domesticate guayule, which is reproduced either by seed, or by root suckers developing on the roots nearest to the surface. But the war stopped these interesting researches, and although, owing chiefly to the work done by Prof. LLOYD, it is known how to cultivate the shrub, it is still unknown whether the cultivated guayule will retain its rubber content outside its natural habitat. Two years before the war Germany tried to introduce guayule into its East African Colony. The war put an end to the experiments. But the author thinks that it is not impossible that Algeria and Morocco may contain arid lands where the rubber plant of the Mexican deserts might become a new source of wealth.

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(1) See *R.*, Sept. 1920, No. 980 ; *R.*, Jan. 1921, No. 51. (*Ed.*)

[724]

725 - The Effect of the Age of the Trees on the Quality of the Rubber. — DE VRIES, O., in *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year 3, No. 3, pp. 89-91. Saigon, March 1921.

The older trees generally possess a latex with a higher rubber content than the younger trees, which naturally influences the yield of rubber to a large extent.

After conducting several experiments on special lines, and by a careful selection of material, the author is now able to present the following information concerning the characteristics of old and young trees.

1) The resistant quality of the resin from old trees is not to any marked extent stronger than of the young trees. In some cases where young trees have not been tapped for some time, less resistance is evident, without necessarily attributing the same to the youth of the trees.

2) The "slope" or type of tension curve is usually the same, occasionally rather better with old trees.

3) The time for vulcanisation becomes appreciably less for old trees; the oldest trees in Java (plantations established from 35 to 40 years) giving the lowest average of all;

4) The viscosity is nearly always of finer quality with old trees, often not coming up to the average with young trees.

Attention is drawn to the fact that in every experiment here undertaken, rubber was prepared in crêpe form as it has not yet been found possible to obtain smoked rubber.

It is interesting to note that these results only partly support the idea that rubber is of better quality when obtained from old trees, e. g. the question of viscosity. The fact that inferior quality rubber is occasionally put on the market by new plantations may be partly attributed to the fact that as a general rule, the older plantations are better equipped and in better working order, and thus encouraging the produce of rubber of more uniformly sound quality.

The author adds that young trees yield a comparatively low quantity of latex with low rubber content, which becomes even more diluted when the cleansing water mixes with the latex, etc. When the dilution of latex is not standardised, these factors often lead to an entire change in qualities relative to the above mentioned properties.

Attention is drawn to the fact that when "Para balls" in Brazil are coagulated with acetic acid, vulcanisation is rapid as a result of the age of the trees; on the one hand, keeping the balls, in a state of moisture for some time, encourages increased speed in vulcanisation, whilst on the other hand, smoking out somewhat retards speed. The results thus in the end coincide. On a Java plantation (Sidoredjo near Samarang) the latex coagulates in a normal way with acetic acid, giving a crêpe after 1 hour 40 minutes, whilst by following the Brazilian coagulation method, only 55 to 65 minutes is required for vulcanisation. However, the latex from the old trees in Brazil treated with a standard mixture and coagulated with acetic acid should give a gum which will vulcanise more slowly.

726 - **Biological Notes on the Gum-Arabic Acacias of the Egyptian Sudan** (1). — PERROT, Em., in the *Comptes rendus de l'Académie des Sciences*, Vol 171, No. 4, pp. 258-260. Paris, July 26, 1920.

About 95 % of the gum arabic of commerce is produced by a small tree, *Acacia Verek* Guill. and Perrot (*A. Senegal* Willd). The Egyptian Sudan (chiefly Kordofan) exports annually nearly 20 000 metric tons of it, whereas Mauritania and Senegal hardly produce more than 2000 metric tons. The other gum-producing species in the Sudan are *A. Seyal* Delile and *A. arabica* var. *nilotica*.

In the course of a recent mission, in February-March, 1920, the author with M. ALLAUD, studied the conditions of growth of the gum trees as well as the method of collection and the trade in gum.

A. Verek commences to form part of the Sudanese bush in the region north of Khartoum and becomes more and more abundant further south in the provinces of Senaar, Gedaref, and Kordofan, but especially in the last named; it then appears in places in the form of fairly thick natural forest which is called " guénéas " and in which the trees are worked by the natives. In the dry season they methodically tap the trees by removing a narrow strip of bark with a crude hatchet (" ferrar ") ; the gummy exudation is thereby considerably increased. In the Province of Kordofan the rainy season lasts from the end of May to the middle of October, and the rainfall is from 300 to 400 mm. During this season of vegetative rest the leaves fall, the air becomes extremely dry, the winds are steady and the temperature exceeds 45°c. in the shade, falling at night sometime several degrees below zero.

The smallest crack in the bark can spontaneously cause the production on the outside of rounded pieces, more or less coloured, called " wady " (wild) gum ; in addition, an insect often punctures the tree at the point of junction of the small branches, and the tree then exudes small spiral threads of gum which are collected and constitute " vermiform " gum. After the barking, along the edges of the wound, rounded, soft and colourless pieces show themselves which dry rapidly and constitute the fine white Kordofan gum.

In seeking to ascertain the best conditions for the gummy exudation the author has formed a certain number of conclusions of which the principal are as follows: —

1) The gum does not exude except during the period of greatest dryness, from December to April, when it is picked every 5 or 6 days.

2) The trees growing in the smallest valleys, or merely in places where the sub-soil, owing to clay strata, remains moist or damp, only produce a few pieces of gum. Also, if the least drop of rain falls after barking has been carried out too early or too late in the season, the first or last picking is spoiled.

3) By simply working the soil to attempt the growth of crops between the trees the production of gum is reduced considerably.

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(1) See *R.*, March, 1921, No. 292. (*Ed.*)

4) The conclusion is therefore that the formation of gum must have as principal object, owing to the reluctance with which it parts with its moisture, to preserve in the tree the amount of moisture necessary for its vegetation during that period of extreme dryness when the desiccation is really extraordinary.

If it is desired to work natural stands, the fact must be kept in view that, as in the case of other desert species, the root system is extremely developed in depth and diameter. A density of not more than 80 to 100 trees per ha. should therefore be preserved, so that there may be very little shade. If the exuding gum heals the wounds, it is a secondary object, as the rough work of barking, which causes injury often up to the cambium, does not apparently otherwise injure the tree.

In Senegal and Mauritania, except among the Peuhls, a tribe which has come from the East, the practice of barking is unknown. The author recommends its introduction since it would enable the yield to be increased by from 3 to 5 times

727 - **The Cultivation of the Vine in Italy during the Last Fifty Years.** — SCANO, G., in the *Giornale vinicolo italiano*, Year 47, No 22, pp. 211-212, 1 diagr Casale Monferrato, May 29, 1921.

In the quinquennium 1870-1874 vines were grown in Italy on 1 869 300 ha. and from 1915 to 1919 on 4 348 800 ha., an increase of 2 479 500 ha., or 132.6 %. This area is distributed over the 16 regions of Italy as shewn in the table,

	Average area in hectares		Increase (+) or decrease (—)
	1870-1874 (1)	1915-1919 (2)	per cent.
Piedmont	117 300	283 800	+ 141.6
Liguria	37 000	52 600	+ 42.2
Lombardy	140 800	246 300	+ 74.9
Venetia	243 000	679 200	+ 179.5
Emilia	168 500	860 000	+ 410.4
Tuscany	226 800	603 500	+ 166.1
Marches	94 800	383 300	+ 304.3
Umbria	50 500	222 900	+ 341.4
Latium	44 000	122 500	+ 178.4
Abruzzi and Molise	170 600	127 900	— 25.0
Campania	103 000	276 400	+ 168.3
Apulia	95 800	204 600	+ 113.6
Basilicata	46 500	30 700	— 34.0
Calabria	95 000	40 700	— 57.2
Sicily	211 500	172 400	— 18.5
Sardinia	24 200	42 000	+ 73.5
Total	1 869 300	4 348 800	*av.* + 132.6

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(1) Data from *Relazione intorno alle condizioni dell'agricoltura nel quinquennio* 1870 a 1874.

(2) Data from *Notizie periodiche di Statistica agraria per gli anni* 1915-1919 published by the Minister of Agriculture

These areas represent, in 1870-1874, 6.5 % of the whole area of the peninsula and, in 1915-1919, 15.2 %, and respectively 7.1 % and 16.5 % of the agricultural area. The region which had the largest area under vines in 1870-1874 was Venetia (243 000 ha.); Tuscany came next (226 800 ha.) and Sicily third (211 500 ha); in 1915-1919 Emilia stood first (860 000 ha.); then came Venetia (679 200 ha.) and Tuscany (603 500 ha.) some way behind.

The region with the smallest area of vineyards in 1870-1874 was Sardinia; in 1915-1919, Basilicata had least.

The greatest extension took place in Emilia where 681 500 ha. were added, and the least in Liguria where the addition was 15 600 ha.; the greatest falling off in area was in Calabria (54 300 ha.), the least in Basilicata (15 800 ha.).

In most of the regions the area under vines has more than doubled, in some (the Marches and Umbria) they have quadrupled; in Emilia it has become 5 times as large. Only in 4 regions (the Abruzzi and Molise, Basilicata, Calabria, Sicily) has there been a decrease. The increase of area under vines has taken place mainly in the North and Central regions of Italy, whilst there has been a decrease, really very slight, in Southern Italy.

728 – **Trentino Vines: — Rossara and Nosiola** (1). — DALMASSO, G, in *L'Italia agricola*, Year 58, No. 3, pp. 78-80, 1 pl Piacenza, March 15, 1921; No 4, pp. 104-105. 1 pl. April 15, 1921.

I. — ROSSARA. — This name or similar names ("Rossera," "Rossea," "Rossarina," "Rossarola") often recur in books on the vine although the vines described may not always be identical with the Trentino stock.

As far as the author knows this vine has only one certain synonym, viz., "Geschlafene," which is used in the Upper Adige; a less certain synonym is "Schwarzwälsche."

In the Venetian Tridentino 2 types of Rossara are distinguished, one with medium bunches of grapes which tend to an ellipsoidal shape and with deeply dentate leaves, the other with large pointed bunches of large round grapes and with leaves slightly dentate. The author describes the second type.

Area of cultivation. — This type is extensively cultivated pretty generally in the Trentino and the Upper Adige as a heavy yielding variety.

Description. — *Stock* very vigorous, growth very strong.

Leaves medium or large, generally 3 lobed, defoliation rather late.

Bunches large or even very large, generally pyramidal, more rarely cylindrical, rather crowded, often winged (in the smallest variety the bunch is more squat and loose).

Berries big, generally spherical (ellipsoid in the smaller variety); in colour varying from red to bluish-red, skin thin but fairly tough, pulp very juicy; flavour simple and pleasant. Stones 1 to 3 in number, fairly large, light yellow.

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(1) See R March 1921, No 302 (*Ed*).

Maturation in the 3rd period late.

Practical information regarding the vines. — The Rossara vine likes fertile soil in plains not too low in altitude; in such a situation it gives abundant yield. In poor stony soils, however, it gives irregular yield.

In certain situations it is subject to drop its fruit. It should be pruned long, in fact it is almost exclusively trained on a " pergola " (trellis roof). At the Institut of San Michele, the average yield over 30 years of the Rossara vine has been 108 hl. per ha.

It is very much affected by anthracnosis and winter cold; it is more subject to mildew than to oidium. It has a good grafting affinity with the principal American stocks.

Practical information regarding the wine. — The Rossara grape generally makes a light wine, with little colour, rather acid. At the Institute of San Michele, the average composition of the must for 30 years was 15.5 % sugar and 8 % acidity. However, blended with Teroldigo or Lagrein or else with Schiave or Vernaccia, it can give good table wines

The Rossara vine grown on certain rather dry lands on the Upper Adige (specially in the neighbourhood between San Michele and Eppan) bears smaller bunches, but produces a wine which, blended with Schiavone, gives the well known and much esteemed " Überetschen " wine which has not much colour, but possesses body and flavour. Similarly, the famous wine of Lake Caldaro (" Kalterersee ") is made by blending Rossara with Schiave

However, among the number of Trentino vines with dark coloured grapes, Rossara is generally that which gives large quantity rather than wine of good quality.

II. — NOSIOLA. — This is one of the most cultivated and interesting of Trentino white grape vines. Outside of the Trentino this vine is distributed over Venetia where it bears the synonym " Durello " or " Durella " Another synonym applied to it in the Upper Adige (Meran) is " Spargelen. " The " Duraca " of Sicily and the white " Durello " of Cesena on the other hand are quite different.

On Monte di Calavino, near Castel Toblino, there are some Nosiola vines which known as " Spinarole, " with very small baby bunches but very numerous. This appears to be the original type of Nosiola.

Area of cultivation. — In the Trentino, the Nosiola vine is cultivated principally at high altitudes :— in the Val di Cembra, near Lavis, and in the Val del Sarca.

Description. — *Shoots* of medium size, sprouting early.

Leaves of medium size or smaller, generally trilobate, lateral sinuses shallow; defoliation medium.

Bunches of medium size, generally cylindrical, sometimes winged, crowded; swelling at end of pedicel, large; brush short

Berries of medium size, spherical; in colour green or light yellow, sometimes golden yellow, pulps hard, slightly crisp, sweet flavoured, fresh, pleasant. Stones generally 3; rather small, dark brown with reddish chalaza.

Maturation in the 2nd period.

Practical information regarding the vines. — The Nosiola vine is a strong growing variety. It requires a dry climate, because in regions where the autumn is damp the grape is likely to rot. On the other hand, cultivated in suitable places, it keeps for even a long time on the racks. It stands heat and drought well. As it sprouts early it is subject to injury from spring frosts In damp springs it is also liable to drop its fruit. It should be pruned long.

It can give a heavy yield, but it is of irregular fertility. As the Agricultural Institute of San Michele, it has given an average yield, for 30 years, of 75 hl. per ha, with a maximum of 168. It is rather sensitive to oidium, on the other hand it is very resistant to anthracnosis.

Practical information regarding the wine — In good situations the Nosiola vine gives a fairly full and pleasant wine, very acid, but inslightly years of heavy yield the quality is rather indifferent.

At the Institute of San Michele the must has given as the average for 30 years, 15.5 % of sugar, and 6.6 per thousand of acidity.

Altogether it constitutes a good type of table wine, not without character.

In the Val del Sarca a good " vino santo " is made from the Nosiola grape, which has acquired a certain reputation especially in the district round Castel Toblino.

729 - **The Malbeck Vine in Argentina and in Italy.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Year II, No. 5, pp. 65-67 Leghorn, May 1, 1921.

The Malbeck vine produces a black grape for making ordinary table wine; it is very common in France, especially in the Bordeaux district, and in Touraine, where is is called " Côt. ". It has some good characters, such as maturation slightly retarded in the 1st period and the production of grapes rich in sugar and colouring matter, but not too rich in acids, so that the wine, not being very astringent while rich in colouring matter, matures rapidly. In Touraine, no doubt owing to the climate and unfavourable soil, it does not produce such a good or deep coloured wine and the vine becomes known as sour Malbeck.

In view of the great diffusion of this vine in France it is not surprising that it has also been introduced into other countries. The great vineyards of the province of Mendoza (Argentina) contain the largest plantations of the Malbeck vine. In the Argentina, this vine has given excellent results regarding the quality of grapes produced, and it is a grape very rich in sugar, which, however, reproduces the character of insufficient acidity in the must, so that the wine is " plat " to use the expression of RENDU. In Argentina that insufficiency of acidity is still more marked than in France, on account of the repeated irrigation necessary in vineyards in hot dry regions such as the two slopes of the Andes range. In Italy, the Malbeck vine has been introduced into several provinces. According to the very careful investigation made by MONDINI, it has been cultivated in 27 provinces but its diffusion has been rather limited on account of its smaller production compared with that of local vines. In the central provinces (Tuscany, Romagna, the Marches and the Abruzzi), the wine has been of good quality. The best Malbeck wine was no doubt the Collemaiino of vineyards planted at Giulianova (Teramo) by Senatore DE VINCENZI; when aged it acquired a delicious bouquet and possessed all the other qualities of a superior table wine, alcoholic, complete flavour, harmonious and extremely pleasant. It was given a gold medal at to the International Exhibition at Bordeaux in 1882.

After the plantations of Giulianova, the Malbeck vine was imported into the Provinces of Caserta (Mignano) and Avellino (Avellino, Sant'Angelo all'Esca). The yield was abundant, but the quality of the wine was not satisfactory, at least in the first few years. The grape was very liable to rot and the wine was not only badly affected by " Casse, " but was also liable to turn sour. These negative characters are very probably due to the climate of these localities, which is rainy during the month of September, especially at the time when the grape ripens.

Thus, whilst at Giulianova the Malbeck grape produces an infinitely better wine than that produced in the Bordeaux district, on the Tyrrhenenian slopes in the two provinces of Campania, on the contrary, inferior wines are produced owing to the difference of climate and soil, viz., a climate with a heavier rainfall and a loose soil in place of clay loam.

According to the author, it is not generally desirable to extend the cultivation of the Malbeck vine, unless experimental cultivation shows that it is advisable. As the vine sprouts late and ripens fairly early, it is consequently very suitable for cold places, both on account of its escaping damage from frosts and on account of the complete ripening of the grape. It stands rain badly as rain favours the development of mildew (to which this vine is too sensitive) and rot in the grapes; when rain falls, during the flowering season which is fairly early, it causes the dropping off of the fruit of vine plants obtained from cuttings taken from unfertile or slightly fertile plants. In Venetia, the Cabernet and Merlot vines are preferred to the Malbeck.

The damage which damp causes to this vine explains the good results obtained in Argentina.

730 - **Experiments on the Cultivation of American Vines on the Hills in the Province of Pisa, Italy.** — RACAH, V., in *L'Agricoltura Toscana*, Year XII, Nos. 5-6 pp. 85-48. Florence, May 15-31, 1921.

The author describes work he has carried out on his experimental vines at S. Marco (Colline Pisane) and he deduces from it that although the planting of 1 ha. of vines now costs from 20 000 to 40 000 lire, if carefully done and well kept, the cultivation of vines is none the less remunerative.

A vine planted in Feb. 24, 1919, using slips of " Trebbiano " grafted on " Riparia, " had grown to a good size and bore large bunches of grapes at the end of 18 months; this shows clearly that it is not always true, that grafted American vines take 6 or 7 years to come into bearing.

The same is the case for certain current ideas which are unfounded; such as, for example, that grafts on American vines grow at first with difficulty and yield insufficient produce, and that vines grafted on American stock do not live more than 15 years. From several hundred 5-year old plants of the "Grand Noir de la Calmette" vine grafted on "Aramon Rupestris No. 1," the author obtained in 1920 over 4 kg. per plant A 29-year-old "Chasselas doré" vine grafted on "Riparia da seme" covers an area of 7 hectares and produced, in 1920, 57 quintals of grapes which were sold at 145 lire a quintal. With abundant manuring (green manuring with beans and lupins every three years, with 6 quintals of superphosphate and 10 quintals of ashes per ha.), il continues to grow vigorously and luxuriantly and gives an abundant crop each year. This proves the accuracy of the statement made by GERVAIS, viz., that the duration of American vines depends, within limits. on the care given to them by the grower.

An American vine which is much estimed for its tolerance of calcareous dry soil is the "Berlandieri Riparia 420 A." It is true that it has the fault that the cuttings root badly but the bad effects of this may be avoided by using short (35 to 40 cm.) cuttings which should be planted very early, that is to say, before they lose their leaves, or very late, i. e., when they have commenced to sprout. It is not true that this vine grows slowly and fruits rather late: one of the authors' vines, 6 years old a "Chasselas d'Alexandrie" or Salamanna (a delicate vine which is subject, in the Tuscana climate, to fungoid disease), grafted on "Berlandieri Riparia 420A" and grown according to THOMERY's system, grows vigorously and gives a high yield.

Many vine-growers hesitate to plant nurseries while they are uncertein as to whether the demand for American stocks will lâst or continue to be remunerative. This is a mistake, for the old nursery plants can be profitably turned into grape-producing vines when it is no longer profitable to grow them for the production of wood. With this object owing to their size, it is not advisable to cleft-graft them, but they should be cut level with the ground and in the following summer only 2 of the numerous shoots given off should be allowed to grow. In the following spring the old vinestock should be cut through obliquely so as to shed rain well above the lower of the two shoots and that shoot can then be grafted.

The idea that vines grafted on American stock are unsuited for training on trees is unfounded; on the Basseto property near Certaldo there are about 80 000 plants of the "San Giovese" vine grafted on "Riparia Gloire" trained on maple trees and growing excellently.

The main thing is the correct choice of the stock. In the flat, moist, deep, fertile soils of the Valdelsa, and generally, in rich, fertile soils, "Riparia Gloire" is an excellent vine for planting over a large area.

On soils not so rich the author recommends the following varieties :— "Riparia Rupestris 101-14" for fairly good soils on plains and on hills; "Aramon Ganzin No. 1" for rather moist clay soils; and "Rupestris du Lot" for gravelly dry soils with permeable subsoil.

731 - **Vine Grafting and Sunstroke.** — RACAH, V., in *L'Italia agricola*, Vol. 58, No. 3, pp. 77-79. Piacenza, March 15, 1921.

Sunstroke or apoplexy of the vine, especially common in grafted vines, is generally due to incomplete union between the graft and the stock. Wounds result which prevent the circulation of the sap; necrosis sets in with the formation of tissues mostly with a spongy texture which are subsequently attacked by fungi.

In the case of slight sunstroke, the author has applied the following treatment successfully:— Laying the vine bare as soon as it commences to wither; watering for 2 or 3 consecutive days with 8 to 10 litres of water; the plants revives and succeed in ripening its fruit, but this treatment, which is only symptomatic and does not reach the origin of the disease, does not cure radically.

To get such a cure two cases must be considered:—

1) *Non-grafted vines.* — The plant should be cut below the lowest point which necrosis has reached and reconstituted with the most vigorous of the shoots, the others being removed, or better still, cut the vine back level with the ground, and graft it.

2) *Grafted vines.* — The plant should be cut below the graft and a new graft made, either on the same stock or on the most vigorous of the shoots. If the tip of the graft is sound, a new graft can be made 8 to 10 cm. above. It is best to cut the vine obliquely and to keep the surface of the cut smooth and clean; it is a good plan to cover the cut with a varnish, the recipe for which, as recommended by the author, is as follows:— Black pitch, Stockholm tar, linseed oil in equal weights; after melting the pitch and the tar and mixing them thoroughly, add the oil and mix the whole thoroughly.

732 - **Experiments or Growing Broad-leaved Trees in Denmark.** — HOLM, C. J., in *Det Forstlige Forsøgsvæsen i Danmark*, Vol. V, Part. 8, pp. 293-299, figs. 1. Copenhagen, 1920.

In forests where gravelly and sandy hills alternate with peat bogs, there is need of a broadleaved tree which will grow on the hills, whilst the pubescent birch (*Betula odorata*) is the most suitable forest tree for peaty soil. For re-afforesting, relatively high sandy and gravelly land spruce has hitherto been principally used; this tree however has the defect of giving too dense shade to the surrounding birches and when the latter are killed blanks ensue which allow free access to the wind and endanger the spruce. In these conditions the Danish Forest Research Station has found it desirable to experiment with a certain number of exotic broadleaved trees in the largest block of the State forests of Northern Seeland

The land on which the experiments were made covers 6 hectares, at an altitude of 40-50 m. in a place where peat bogs lie between hills of gravelly sand mixed here and there with a little clay. The trees most extensively grown are *Quercus rubra* and *Betula odorata*; experiments have also been made with *Quercus palustris* and *Q. coccinea, Betula lutea* and *B. Maximowiczii, Acer Negundo, Fraxinus americana, Cercidiphyllum japonicum.*

Acanthopanax ricinifolium and *Albizzia Juliprissin*. Some of these trees have proved incapable of standing the rigours of winter followed by spring frosts, but the three species of American oak have done as well as could be desired, although they also have suffered somewhat from the cold. Among the birches, the Japanese *Betula Maximowiczii* Rgl. has turned out a well grown tree with well developed leaves.

733 - **The Identification of Different Timbers** (1).—PICCIOLI, L. (Professore Ordinario di Tecnologia del legno nel R. Istituto superiore forestale nazionale di Firenze), in *I. I. I.*, *Rassegna settimanale illustrata della produzione italiana*, Year V, Gen. Ser. No. 16 Sect C., No. 4, pp. 13-15, figs. 3 Milan, April 1921.

All timbers can be placed in 2 classes:—

I) Gymnosperms, whose timber has no vessels;

II) Angiosperms, whose timber contains vessels which traverse it longitudinally.

The latter includes:—

1) Monocotyledons, without annual rings, with fibro-vascular bundles arranged irregularly (reed, butcher's broom, rattan, palm, bamboo, etc.).

2) Dicotyledons, with annual rings, vessels, tracheids, fibres, and parenchyma. The real commercial timbers belong to the Gymnosperms (more precisely to the family of the Conifers) and to the Dicotyledons; for this reason the timbers dealt with are limited to these. As a guide to the division of types, series and groups, the rules which the author gives in summing up his investigations should be borne in mind.

CONIFERS. — These are distinguished from Dicotyledons by the simplicity of their structure because the wood is formed of tracheids and contains no vessels.

They may have radial resin canals, but the annual rings are nearly always visible, because the cells of the autumn zone have always thicker walls and smaller cavities than those of the spring zone. The structure of these timbers can be subdivided into the following types:—

TYPE I. — Tracheids with wide spiral thickening inside.

(1) Timber without resin canals, very hard, sapwood yellowish white and heartwood red brown. Specific gravity of air-dried wood, 0.73. — Yew (*Taxus baccata*).

(2) Timber with resin canals, medium hardness, sapwood narrow and light coloured, heartwood brown — Oregon pine = Douglas spruce = red fir = yellow fir = sapin odorant = sapin américain (*Pseudotsuga Douglasii*).

TYPE II. — Tracheids without inside spiral thickening.

Section I. — Timber with resin canals.

(A) Heartwood of different colour to the sapwood; rays with transverse tracheids above and below.

a) Sheath of the resin canals thin walled;

α) Transverse tracheids of the rays with pitted thickening;

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(1) L. PICCIOLI, *Selvicoltura* Turin, Unione tipografico-editrice torinese, 1915.— IDEM, *Tecnologia del legno*, Turin U. T. E. T., 1919. (*Ed.*)

β) Autumn tracheids with thin spiral stripes.

1) Fields of crossing of rays and tracheids with 1-2 large holes; rays composed 12 rows of cells; sp. gr. 0.67. — *Pinus Laricio.*

2) Fields of crossing with 2-4 large holes; rays of 10-25 rows of cells; sp. gr. 0.75-0.90. — Pitch pine (*Pinus palustris*).

3) Fields of crossing as above; rays of 5 to 12 rows of cells, sp. gr. 0.67. — *Pinus Pinaster.*

γ) Autumn tracheids without special stripes; rays of up to 18 rows of cells; sp. gr. 0.32. — Scots pine (*Pinus sylvestris*).

δ) Transversal tracheids without pitted thickening.

1) Fields of crossing with 2-3 areolae, rays of 6 to 11 rows of cells; sp. 0.67. — *Pinus Pinea.*

2) Fields of crossing with only 1 areola, rays of up to 20 rows of cells; sp. gr. 0.41 — White pine (*Pinus Strobus*).

b) Sheath of the resin canals with dense well lignified walls; rays of up to 20 rows of cells; sp. gr. 0.60. — Larch (*Larix europaea*).

B) Heartwood the same colour as the sapwood or nearly so; rays of 20 to 30 rows of cells; sp. gr. 0.44. — Spruce (*Picea excelsa*).

Section II. — Timber without resin canals.

A) Medullary rays without transversal tracheids.

1) Rays of more than 20 rows of cells; fields of crossing with 2-4 areolae; sp. gr. 0.62. — Cypress (*Cupressus sempervirens*).

2) Rays of 25 rows of cells; sapwood and heartwood very distinct; sp. gr. 0.75. — Juniper (*Juniperus communis*).

3) Rays of at most 8 rows of cells; field of crossing with 2-6 areolae; sp. gr. 0.46. — *Sequoia sempervirens*

4) Rays of 10 to 15 rows of cells. — *Araucaria brasiliensis.*

5) Rays up to 30 rows of cells; sp. gr. 0.44. — Silver fir (*Abies pectinata*).

6) Rays of 2 to 4 rows of cells; sp. gr. 0.42. — Ginko (*Ginkgo biloba*).

B) Medullary rays with transverse tracheids or special cells.

1) Fields of crossing with a single large elliptic hole. — *Sciadopitys verticillata.*

2) Fields of crossing with 2-4 areolae. — *Tsuga canadensis.*

3) Fields of crossing with 4-8 areolae in series. — *Taxodium distichum.*

DICOTYLEDONS. — TYPE I. — Vessels of the spring zone of the annual rings forming a porous circle; rings very distinct.

Section I. — Large rays (15-30 rows of cells), easily visible with the naked eye (0.6 to 1 mm. wide).

A) Vessels of the autumn zone arranged in radial lines.

a) Medullary rays, some large and some very small.

α) Sapwood of 15-30 rings.

1) Timber with fibres somewhat twisted; the smaller vessels and the tracheids of the autumn zone arranged in radial bands like a fan and not branched; sp. gr. 0.74. — Sessile flowered oak (*Quercus sessiliflora*).

2) Timber with straight fibre; small vessels and tracheids of the autumn zone in bifurcating lines; sp. gr. 0.75. — Pedunculate oak (*Quercus pedunculata*)).

β) Sapwood of 10-15 rings; rays smaller than in the 3 preceeding species; sp. gr. 0.74. — *Quercus Farnetto.*

b) Between the large medullary rays and the very small ones, are others of medium size (2-4 rows of cells); sp. gr. 0 73. — *Quercus macedonica.*

B) Small vessels of the autumn zone in irregular groups; sp. gr. 0.83. — *Quercus Cerris.*

Section II. — Medium rays (6-12 rows of cells), visible with the naked eye.

Series I. — Vessels of the autumn zone arranged uniformly.

1) Sapwood greenish white or grey, 30 rings, and heartwood brown; sp. gr. 0.75. — *Celtis australis.*

2) Timber yellow; rays undulating; sp. gr. 0.80. — *Koelreuteria paniculata.*

3) Shrub with yellow sapwood and bluish red heartwood; sp. gr. 0.75. — Berberry (*Berberis vulgaris*).

Series II. — Vessels of the autumn zone in tangential lines (circular) or forming hieroglyphics. Sapwood and heartwood more or less distinct.

1) Timber soft, porous, sapwood yellowish white and heartwood red brown; medulla with secretory canals; sp. gr. 0.57. — Persian lilae (*Melia Azedarach*).

2) Timber semi-hard, sapwood straw coloured and heartwood chestnut coloured; rings slightly undulating; medulla 5-6 mm.; sp. gr. 0.69. — Coffee tree (*Gymnocladus canadensis*).

3) Timber semi-hard; sapwood ample, yellow, brown and not very different from the orange heartwood; medulla with numerous peripheral secretory canals; sp. gr. 0.66. — *Ailanthus glandulosa.*

4) Timber semi-hard; sapwood yellowish white and heartwood red brown; sp. gr. 0.65. — White Mulberry (*Morus alba*).

5) Timber hard; sapwood yellowish white (3-8 rings) and heartwood brown; sp. gr. 0.74. — Alpine laburnum (*Laburnum alpinum*).

6) Timber hard; sapwood yellowish white, compact, and heartwood dark brown; sp. gr. 0.67. — Elm (*Ulmus campestris*).

Series III. — Vessels of the autumn zone in groups; sapwood cream coloured and heartwood brick-red; sp. gr. 0.81. — *Gleditschia triacanthos.*

Section III. — Rays small (3-4 rows of cells), invisible, or almost so, to the naked eyes.

α) Autumn vessels isolated; timber whitish, hard; medulla reddish; sp. gr. 0.66. — Judas tree (*Cercis Siliquastrum*).

b) Autumn vessels in radial lines; timber yellowish white, soft. — (*Styrax officinale*).

c) Autumn vessels in tangential lines or groups.

α) Sapwood yellow or straw coloured.

1) Heartwood brown; vessels tylose; parenchyma round the vessels; sp. gr. 0.70. — *Robinia Pseudo-Acacia.*

2) Heartwood brown; vessels without "thyllae"; parenchyma tangential, sp. gr. 0.68. — *Sophora japonica.*

3) Heartwood yellowish brown, stains orange with potassium hydrate and violet with hydrochloric acid; sp. gr. 0.92. — *Chlophora tinctoria.*

4) Heart wood dark or sooty, porous, light, fragile, odorous, aromatic; sp. gr. 0.49. — *Sassafras officinale.*

β) Climbing shrub; timber porous with large extremely tylose vessels. — Wistaria (*Wistaria chinensis*).

Section IV. — Rays very small, invisible to the naked eye, of 1-3 rows of cells.

Series I. — Autumn vessels isolated.

1) Tree with soft timber, yellowish white or reddish white; medulla white, 1 cm. broad; sp. gr. 0.43. — *Paulownia imperialis.*

2) Shrub with hard timber, sapwood yellowish white and heartwood violet-brown, medulla snow white, 1 mm. — Lilac (*Syringa vulgaris*).

Series II. — Autumn vessels in radial lines.

1) Tree with yellowish white sapwood and brown heartwood; rays of a single row of cells; sp. gr. 0.61. — Chestnut (*Castanea sativa*).

2) Shrub; rays of 2 to 3 rows of cells. — *Phillyrea variabilis.*

Series III. — Autumn vessels in short series.

1) Vessels very tylose; timber soft; sapwood whitish and heartwood olive and sooty; sp. gr. 0.45. — *Catalpa bignonioides.*

2) Vessels not tylose; timber hard; sapwood reddish and heartwood light brown; sp. gr. 0.74. — Ash (*Fraxinus excelsior*).

TYPE II. — One circle of porous spring wood (large vessels) wanting in the spring zone of the annual ring.

Section I. — Medullary rays large and easily visible with the naked eye.

Series I. — Vessels isolated or in irregular groups or in very short lines.

Group I. — Vessels distributed uniformly and of equal size throughout the ring.

A) Vessels visible with the naked eye, isolated, or in lines of 2-7.

α) Vessels isolated and numerous. — Climbing shrubs with spongy and very flexible timber.

1) Sapwood yellow brown and heartwood red brown; sp. gr. 0.65. — Vine (*Vitis vinifera*).

2) Timber yellowish green, no heartwood; sp. gr. 0.40. — Clematis (*Clematis Vitalba*).

b) Vessels rare.

α) Parenchyma in thin peripheral lines visible with the naked eye.

1) Timber heavy; sapwood yellowish white or light brown, 15-20 rings, and heartwood reddish brown often veined; sp. gr. 0.64. — Walnut (*Juglans regia*).

2) Timber soft, icterical yellow, no heartwood; sp. gr. 0.71. — Fig tree (*Ficus Carica*).

β) Parenchyma perivascular, not visible with a magnifying glass; sapwood yellowish white and heartwood red brown. Timber hard; sp. gr. 0.71. — Tamarisk (*Tamarix gallica*).

B) Vessels invisible to the naked eye.

a) Medullary rays large with 5-20 rows of cells.

1) Heartwood brown and sapwood reddish white, semi-hard, very rich in vessels and rays enlarged where they meet the annual rings; sp. gr. 0.61. — Plane (*Platanus orientalis*).

2) No heartwood; timber greenish white; very hard; sp. gr. 0.89. — Holly (*Ilex Aquifolium*).

b) Rays, some large (12-15 rows of cells), some very small; sapwood 50-80 annual rings; timber of medium hardness without real heartwood; sp. gr. 0.74. — Beech (*Fagus sylvatica*).

c) Apparently large rays (because they are formed by the crowding of a great number of small rays), small rays of a single line of cells.

1) Timber soft with many medullary spots; sp. gr. 0.55. — Alder (*Alnus glutinosa*).

2) Timber very hard, whitish, without medullary spots; medulla homogeneous. Tree; sp. gr. 0.82. — Hornbeam (*Carpinus Betulus*).

3) Timber fairly hard; medulla heterogeneous. Shrub; sp. gr. 0.65. — Hazel (*Corylus Avellana*).

d) Rays medium, but visible with the naked eye owing to the different colour of the wood.

1) Tree with medullary rays more compact than the tissue of the wood, 5-6 rows of cells. Timber whitish or reddish yellow, no heartwood; sp. gr. 0.66. — Sycamore (*Acer Pseudo-Platanus*).

2) Bushes or shrubs with rays as compact as the tissue of the wood; timber pale yellow, homogeneous, hard, sp. gr. 0.80. — Lemon (*Citrus Limonum*).

3) Shrub; rays of 10 rows of cells; timber whitish or light brown. — Trailing Dog-Rose (*Rosa arvensis*).

Group II. — Spring vessels more numerous than those of autumn, so that they form a less dense and lighter coloured zone; sapwood and heartwood.

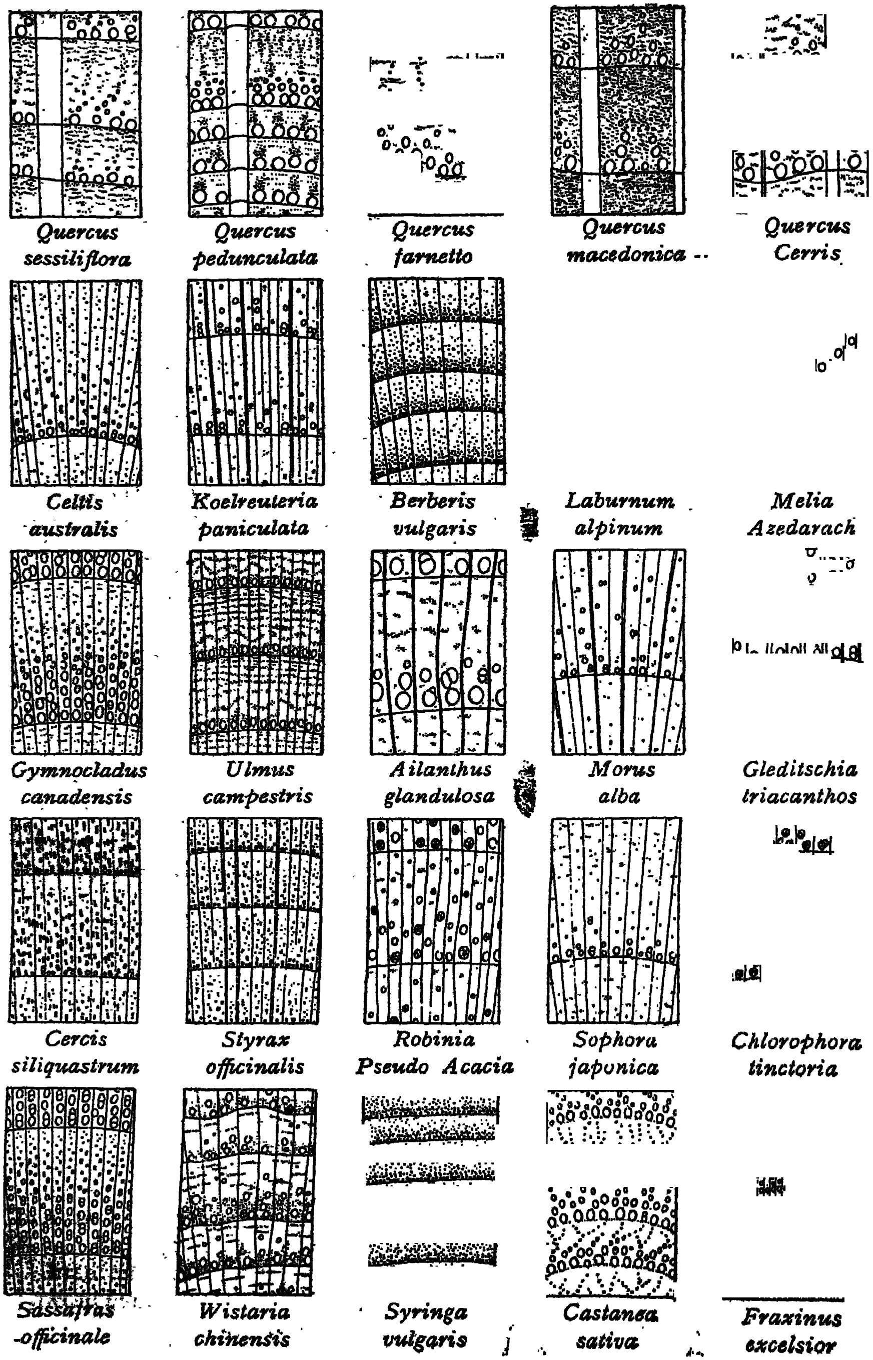
1) Sapwood narrow (8-12 rings), yellowish white; heartwood very hard, violet or chestnut brown like mahogany, with veins; sections seen by transmitted light appear blood brown; sp. gr. 0.75. — Plum (*Prunus domestica*).

2) Sapwood reddish white with medullary spots and heartwood brown; timber semi-hard; sp. gr. 0.66. — Bird Cherry (*Prunus avium*).

3) Sapwood compact, yellowish white, heartwood red brown and veined, very hard; sp. gr. 1.00. — Almond (*Prunus Amygdalus*).

Series II. — Vessels in radial undulating series. Timber hard.

1) Small vessels and tracheids in irregular groups; timber red brown; very hard; sp. gr. 0.90-1.18. — Ilex (*Quercus Ilex*).



Quercus sessiliflora · *Quercus pedunculata* · *Quercus farnetto* · *Quercus macedonica* · *Quercus Cerris*

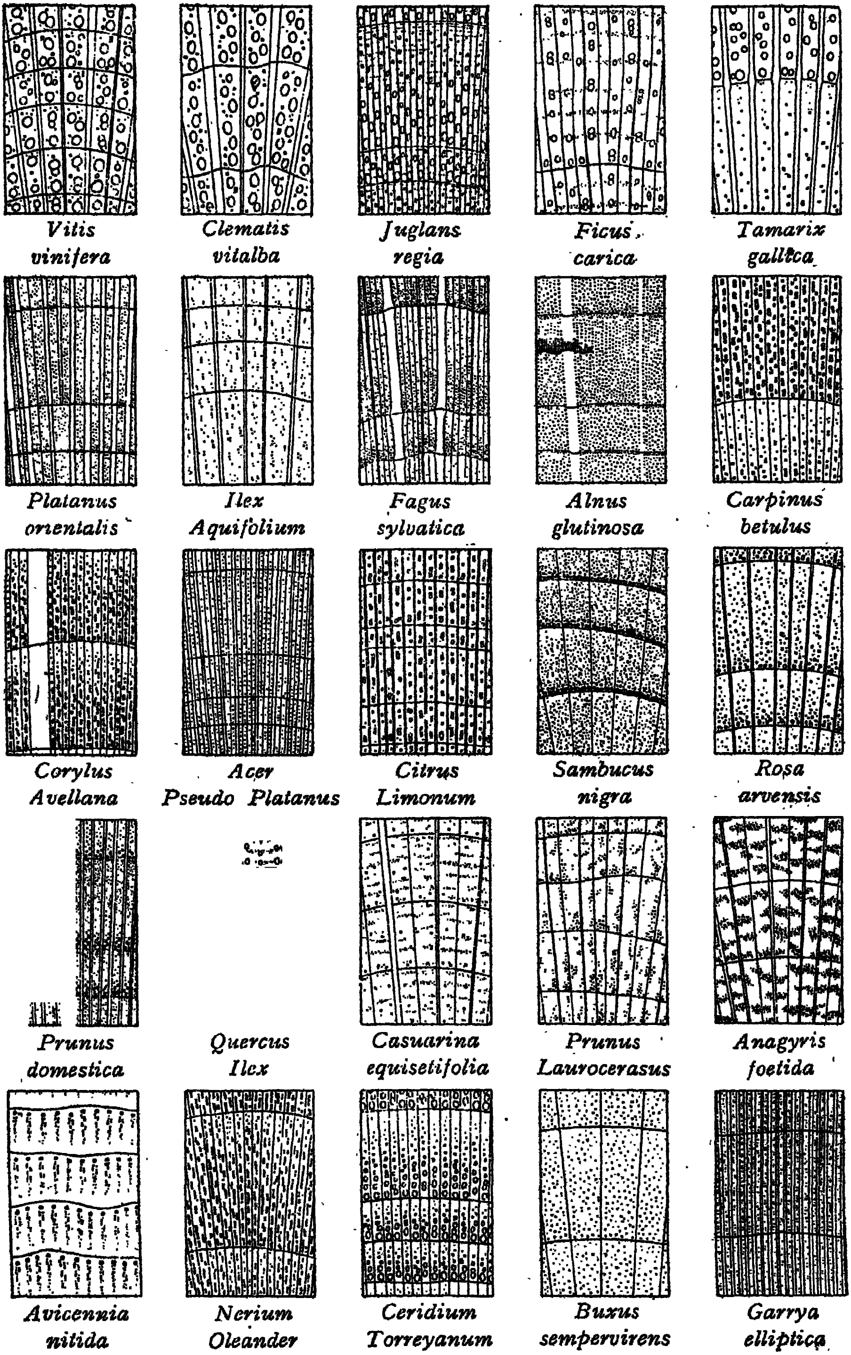
Celtis australis · *Koelreuteria paniculata* · *Berberis vulgaris* · *Laburnum alpinum* · *Melia Azedarach*

Gymnocladus canadensis · *Ulmus campestris* · *Ailanthus glandulosa* · *Morus alba* · *Gleditschia triacanthos*

Cercis siliquastrum · *Styrax officinalis* · *Robinia Pseudo Acacia* · *Sophora japonica* · *Chlorophora tinctoria*

Sassafras officinale · *Wistaria chinensis* · *Syringa vulgaris* · *Castanea sativa* · *Fraxinus excelsior*

Fig. 1. — Transverse sections of timbers (from *Quercus sessiliflora* to *Fraxinus excelsior*). Magnified 5 diameters.



Vitis vinifera

Clematis vitalba

Juglans regia

Ficus carica

Tamarix gallica

Platanus orientalis

Ilex Aquifolium

Fagus sylvatica

Alnus glutinosa

Carpinus betulus

Corylus Avellana

Acer Pseudo Platanus

Citrus Limonum

Sambucus nigra

Rosa arvensis

Prunus domestica

Quercus Ilex

Casuarina equisetifolia

Prunus Laurocerasus

Anagyris foetida

Avicennia nitida

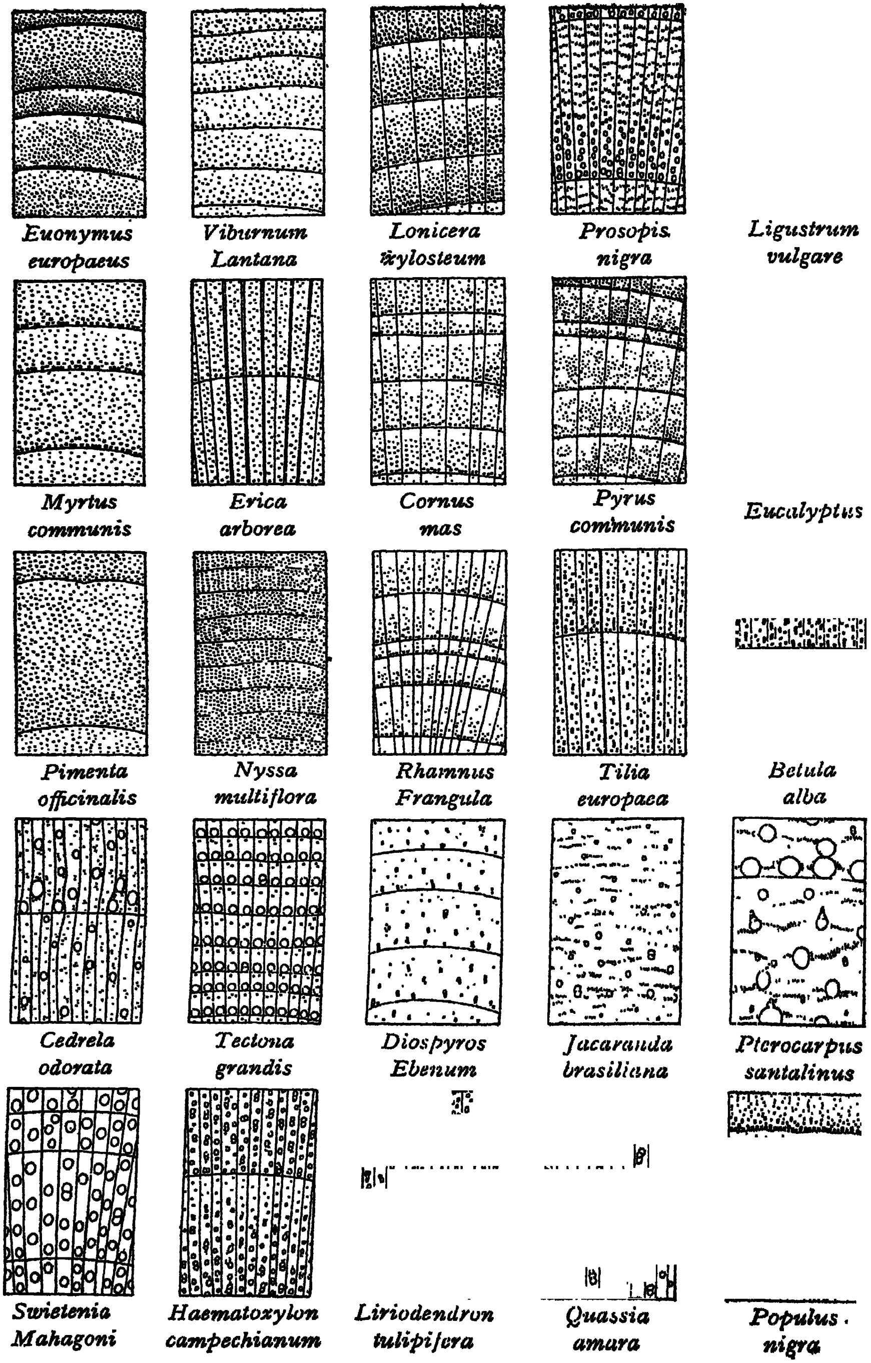
Nerium Oleander

Ceridium Torreyanum

Buxus sempervirens

Garrya elliptica

Fig. 2. — Transverse sections of timbers (from *Vitis vinifera* to *Garrya elliptica*).
Magnified 5 diameters.



Euonymus europaeus
Viburnum Lantana
Lonicera Xylosteum
Prosopis nigra
Ligustrum vulgare
Myrtus communis
Erica arborea
Cornus mas
Pyrus communis
Eucalyptus
Pimenta officinalis
Nyssa multiflora
Rhamnus Frangula
Tilia europaea
Betula alba
Cedrela odorata
Tectona grandis
Diospyros Ebenum
Jacaranda brasiliana
Pterocarpus santalinus
Swietenia Mahagoni
Haematoxylon campechianum
Liriodendron tulipifera
Quassia amara
Populus nigra

Fig. 3. — Transverse sections of timbers (from *Euonymus europaeus* to *Populus nigra*). Magnified 5 diameters

2) Small vessels in short series over the whole ring ; timber yellow brown ; sp. gr. 0.95. — Cork Oak (*Quercus Suber*).

b) Heartwood wanting; timber light yellow; bush with rays of up to 3 rows of cells. Medulla round or oval. — Laurel Cherry (*Prunus Laurocerasus*).

Series III. — Vessels in tangential (peripheral) lines; timber very hard.

1) Heartwood reddish brown, sapwood greyish white. Tree; sp. gr. 0.80-1.01. — *Casuarina equisetifolia.*

2) Timber yellowish. Shrub — *Anagyrus foetida.*

Section II. — Rays imperceptible, or nearly so, to the naked eye.

Series I — Vessels in radial lines.

1) Tree with very hard timber, rings very indistinct; sapwood yellowish white and heartwood brown with dark veins; sp. gr. 0.86-1.00. — Olive (*Olea europea*).

2) Tree with hard timber, whitish veins, sapwood ash-grey and heartwood brown; rings distinct, very irregular, with large canals in tangential lines ; sp. gr. 0.95. — *Avicennia nitida.*

3) Shrub or bush; timber soft, straw yellow or white, with distinct rings ; medulla triangular ; sp. gr. 0.56. — Oleander (*Nerium Oleander*).

Series II. — Vessels in tangential lines or bands ; timber hard

1) Tree with heartwood sooty chestnut ; rays of 1-2 rows of cells; sp. gr. 0.83. — *Astronium fraxinifolium.*

2) Shrub ; timber nut-coloured ; rays very thick. — *Myoporum debile.*

3) Shrub ; timber straw coloured or greenish white. — *Pittosporium Tobira.*

4) Tree ; sapwood yellow brown and heartwood red brown ; rings undulating. Rays of 4-5 rows of cells, with fine silky polished surfaces of 5-10 mm. height ; sp. gr. 0 70. — *Ceridium Torreyanum.*

Series III. — Vessels isolated or in small groups irregularly distributed.

Group I. — Vessels isolated.

(*A*) Timber hard or very-hard.

a) Heartwood or timber altogether lemon-yellow or dun ;

1) Timber lemon-yellow, very hard ; rays of 1-3 rows of cells; medulla 0.5 mm. ; sp. gr. 0.92. — Box (*Buxus sempervirens*).

2) Timber dun ; rays of up to 8 rows of cells ; medulla 2-3 mm. — *Garrya elliptica.*

b) Heartwood or timber altogether yellow brown, brown, reddish yellow or sooty.

1) Heartwood brown, sapwood yellowish white ; rays of a single row of cells; medulla white, quadrangular, 2 mm. Shrub; sp. gr. 0.68 Spindle-tree (*Euonymus europaeus*).

2) Heartwood yellow brown and sapwood reddish white ; timber hard ; rays of 1-3 rows of cells ; medulla angular, 1.5 mm. Shrub ; sp. gr. 0.93. — Wayfaring-tree (*Viburnum Lantana*).

3) Heartwood brown, compact, very hard; sapwood 5-12 rings; medulla 5-8 mm. reabsorbed when fully grown. Rays of 1-3 rows of cells; sp. gr. 0.80. — Upright Fly Honeysuckle (*Lonicera Xylosteum*).

4) Heartwood sooty and sapwood dun; rays very thick, lighter in colour than the wood; sp. gr. 0.65-0.80. — *Prosopis nigra.*

5) Heartwood reddish yellow or sooty, very close grain, hard, silky; rays lighter in colour than the wood; sp. gr. 1.07. — *Dipteryx odorata.*

c) Heartwood violet brown; sapwood straw colour; medulla snow-white, 12 mm. Shrub. — Privet (*Ligustrum vulgare*).

2) Heartwood greenish brown with dark veins; sapwood dun; timber very hard, with an acrid aromatic taste and a resinous smell; sp. gr. 1.27. — Guiacum (*Guajucum officinale*).

d) Heartwood or timber altogether reddish or red brown, compact, homogeneous, hard.

1) Timber reddish, no heartwood, rays of 1-2 rows of cells. Shrub; sp. gr. 0.81. — Myrtle (*Myrtus communis*).

2) Timber with reddish brown heartwood and yellowish white sapwood; rays of 1-4 rows of cells; medulla white, round, 3 mm. Shrub. — *Philadelphus coronarius*

3) Timber reddish, no heartwood; rays of up to 6 rows of cells. Timber of the roots (" bruyère ") is mottled. Shrub; sp. gr. 0.94. — Tree heath (*Erica arborea*).

4) Timber with red brown heartwood and pinkish yellow sapwood; rays of 1-3 rows of cells darker in colour than the wood; shrub, sp. gr. 0.96. — *Arbutus Unedo.*

5) Timber with reddish heartwood and light coloured sapwood of 20-25 rings; medulla snow coloured, 0.5-1 mm. Rays of up to 5 rows of cells; sp. gr. 1.03. — Cornelian Cherry (*Cornus mas*).

6) Timber without true heartwood, reddish brown; medulla white, round, and 1 cm. broad; sp. gr. 0.75. — Pear (*Pyrus communis*).

7) Timber without heartwood, light yellow; rays of 1-3 rows of cells; medulla round, white, and 1 cm. broad; shrub; sp. gr. 0.96. — Elder (*Sambucus nigra*).

e) Heartwood red brown or reddish, brick red, chestnut, umber, or dark purple, etc.; trees of foreign origin.

1) Timber red brown or reddish; vessels full of yellow-brown resin; rays of a single row of cells. — *Eucalyptus* spp.

2) Heartwood red brown alternating with yellowish parts, rose scented; sp. gr. 1.00. — Brazil rosewood (*Physocalymna scaberrimum*).

3) Heartwood red brown or wine colour, rich in red colouring matter, aromatic scent and sweetish taste; sp. gr. 1.01. — *Caesalpinia Crista.*

4) Heartwood brick red, sapwood dun or tortoise, rays of 3-4 rows of cells, with polished surfaces like those in beech; sp. gr. 1.20. — Mangrove (*Rhizophora Mangle*).

5) Timber brick colour, compact, easily polished; parenchyma is very dense in very fine peripherical lines of 2-4 elements; sp. gr. 1.10 — *Lecythis grandiflora.*

f) Heartwood chocolate, chestnut, umber or coffee colour, parenchyma in fine peripherical lines.

1) Heartwood chocolate. — *Pimenta officinalis.*

2) Heartwood chestnut, violet or blackish veins, smells of anise; sapwood narrow, grey or tortoise. Difficult to cut except when green on account of its hardness; sp. gr. 1.10-1.29. — Assam Iron wood (*Mesua ferrea*).

3) Heartwood umber or coffee colour, aromatic; sapwood narrow, whitish or light brown; rays of 3-5 rows of cells, vessels contain oleoresin; sp. gr. 0.50-0.93. — Teak *Tectona grandis*).

(*B*) Timber soft, light.

a) Shrub, sapwood light yellow 10 rings and heartwood reddish yellow; sp. gr. 0.62. — Alder Buckthorn (*Rhamnus Frangula*).

b) Trees.

1) Timber white, like tow, without heartwood; medulla white, quadrangular, 2-4 mm., sp. gr. 0.65. — Horse chestnut (*Æsculus Hippocastanum*).

2) Timber with cinnamon or tobacco-coloured heartwood and reddish white sapwood, aromatic, bitter; rays of 4-6 rows of cells; large vessels; sp. gr. 0.56. — *Cedrela odorata.*

3) Timber with light-brown heartwood and sapwood of 30-100 annual rings, yellow, straw yellow or light colour, resembling timber of willows and poplars; vessels very small and very numerous; rays very fine, white and shining; sp. gr. 0.65. — *Nyssa multiflora.*

4) Timber and heartwood reddish brown sapwood cream or dun; annual rings undulating and seen best by transmitted light; rays very dense, fine, with fine, graceful surfaces; sp. gr. 0.63. — *Liquidambar styraciflua.*

Group II. — Vessels partly in pairs, in lines or in groups of 3 to 10.

A) Timber bony or stony.

1) Heartwood black (the only part used commercially); sapwood narrow, yellow brown; sp. gr. 1.16. — Ebony (*Diospyros Ebenum*).

2) Heartwood bay or dark purple; sp. gr. 0.81-1.03. — White Quebracho (*Aspidosperma Quebracho*).

3) Heartwood red brown with blackish stripes; sapwood very narrow, grey, rose scented when green (rose wood); boiled with water it gives a yellow tint; with alcohol pink-violet; with ammonia dark brown, sp. gr. 0.86. — *Jacaranda brasiliana.*

(4) Heartwood dark red outside and light inside, pleasant scent and bitter taste. Large vessels isolated and joined by transverse lines of small vessels; sp. gr. 0.75.-1.04. — *Pterocarpus santalinus*

(*B*) Timber hard; heartwood reddish brown and sapwood light brown; vessels contain gum; rays of 2 rows of cells; sp. gr. 0.70-0.85. — Mahogany (*Swietenia Mahagoni*).

(*C*) Timber soft.

(*a*) Vessels partly arranged in radial lines of 3 to 11; timber yellowish or yellow brown; rays of 2-5 rows of cells; sp gr. 0.57. — Tulip tree (*Liriodendron tulipifera*).

(*b*) Vessels in groups or lines of 2 to 5.

(α) Timber bitter, straw yellow. — *Quassia amara.*

(β) Timber tasteless, light.

(1) Timber whitish without medullary spots and without heartwood; vessels with spiral thickenings; sp. gr. 0.58. — Lime tree (*Tilia europaea*).

(2) Timber without medullary spots, sapwood yellowish white and heartwood light in colour; vessels without spiral thickenings; sp. gr. 0.41. — Black Poplar (*Populus nigra*).

(3) Timber with medullary spots, yellowish white or reddish white; vessels without spiral thickenings; sp. gr. 0.73. — White Birch (*Betula alba*).

Series IV. — Vessels with reticulations, hieroglyphics, or slanting bands.

(1) Trees with yellowish white sapwood, 3 or 4 rings, and heartwood dark brown of coarse tissue, hard; sp. gr. 0.86. — *Laburnum anagyroides.*

(2) Shrub with yellowish white sapwood, abundant; heartwood reddish yellow; medullary rays of 1 to 3 cells; sp. gr. 0.81. — *Pistacia Lentiscus.*

LIVESTOCK AND BREEDING

734 - **Experiments in France on Milking Cows Suffering from Foot and Mouth Disease even when the Teats showed Lesions in Order to Maintain Milk Secretion Near to the Quantity obtained before the Disease appeared.** — PORCHER, *Ch.*, in the *Comptes rendus des séances de l'Académie des Sciences*, Vol. 171, No. 2, pp. 122-125. Paris, July 12, 1920.

The analysis of the milk during the course of foot and mouth disease reveals great discrepancies in the chemical composition. The author has demonstrated experimentally that, in cases where the percentages of the components of the milk were in deficit, the retention of milk, following suspended or restricted milking, acted in proportion of the extent to which the teats were affected by the disease.

In a milch cow affected by foot and mouth disease and in which the disease showed typical development, the teat *AL* (anterior left) which first showed lesions was not milked, whilst milking was done on the other teats ($A\ R + P\ R + P\ L$).

Milking was resumed on teat *AL* after 48 hours. The analytical data, recorded in a table, enable the following conclusions to be drawn: -

1) The retention of milk for two days in the quarter *AL* has furnished results which are in perfect agreement with those previously obtained namely:— Decrease of lactose, increase of salts, constant cryoscopic diminution, large decrease in the refractive index and notable increase in conductivity.

2) By retention in one quarter, milk secretion returns but slowly to its previous level.

3) On the other hand, by milking the teats affected by aphthae,

the quantity of milk obtained is little less than it was before the disease declared itself; this deduction is made from the fact that the cow in question, which gave 13.25 litres of milk on May 10, the day before the disease showed itself, gave 11 75 litres of milk of May 21, four days after retention in teat *AL* (which had lasted 48 hours) was discontinued.

According to the author the functional effort of the mammary gland during the disease, intensified by increasing the number of milkings up to 3, or even 4, a day, would cause the lactic secretion to come very nearly up to the quantity obtained previous to the disease and to do so more quickly.

735 - **Preservation of Aphthous Virus by Cold.** — LEBAILLY, C., in the *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 20, pp 1261-1262. Paris, May 17, 1921.

The author has tried the preservation of aphthous products in a freezing machine working between —4° and —8°C; 800 cc. of the blood of an ox at the height of an attack of foot and mouth disease was drawn off aseptically in a phial containing 50 cc. of a sterilised 10 % solution of sodium citrate in distilled water, and then distributed in small phials. The temperature not being sufficiently constant the virus was subjected to alternate freezing and thawing. However, it proved to be still active after 72 hours in 10 cc. doses injected subcutaneously. There is no doubt that by means of apparatus working regularly much better results would be obtained; the author is continuing his experiments with this object.

736 - **Efficiency of Chloroform and Thymol Against Hookworms (*Uncinaria polaris*) in the Silver Black Fox of Canada.** — ALLEN, J. A in *Journal of the American Veterinary Medical Association*, Vol LIX, No 1, pp. 62-72. Washington, April 1921.

In Canada, particularly in the province of Prince Edward Island, the raising of silver-black foxes in captivity has become an important industry and foxes are now also being bred in other provinces of Canada, the United States, Japan and some European countries.

During 1920, the approximate value of the foundation stock and of the pelts marketed that year is said to be $ 1 400 000 and this sum exceeds the revenue derived from all other classes of live-tock in this small province which has a population of less than 100 000 people. During 1920, there were over 2000 live foxes exported from the Island which has always been regarded as the principal breeding centre.

Investigations dealing with a considerable number of carcasses combined with further data obtained by the Fox Research Station have shown a large percentage of the animals harboring hookworms (*Uncinaria polaris* Loos).

It is the experience of practical fox farmers that a much larger percentage of foxes are now developing undesirable texture and colours. There are two conditions that have given fox breeders much concern: 1) Woolliness and 2) rust. In the first case the fur loses its silky texture, feels much like wool and the long hair (guard hair) does not grow to the required length. With rust, the fur takes on a reddish or brownish hue instead of the deep, glossy blue-black colour that characterises a prime pelt.

The fact that over 68% of the woolly and stunted animals used in this experiment harbored hookworms is significant.

The author has conducted a series of experiments on the most efficacious treatment of this disease with a view to reducing as much as possible the number of tainted furs. The results are summarised as follows:

1) *Uncinaria polaris* when present in large numbers undoubtedly influences the condition of the fur.

2) Chloroform is inefficient as an anthelmintic against hookworms in foxes and is also a dangerous drug, producing a mortality of 50 % in the present experiments.

3) Thymol showed a high degree of efficiency (87.8 %) when given to foxes on the basis of 0.13 gm. per kg. of body weight with this dose repeated in 2 hours. Before and after the anthelmintic given in capsule form, the animals received a purgative (magnesium sulphate).

From this dosage, a mortality of 18.7 % followed which makes it somewhat dangerous for universal application.

4) When thymol is used on the basis of 0.065 gm. per kg. of weight and the dose repeated in 2 hours, an efficiency of at least 33 % may be expected, and the mortality is reduced to about 6.8%; one dose given thus apparently has little or no anthelmintic effect.

737 - **Fattening Experiments on Pigs with "Maismastfutter" and Sweet Moist Lupins Respectively, in Germany.** — MÜLLER, K. (Director of the Experimental Farm at Ruhlsdorf (Teltow), for keeping, feeding and breeding pigs), in: — I. *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No. 29, p. 221. Berlin, April 1921. — II. *Deutsche Landwirtschaftliche Presse*, No. 36, pp. 275-276, Berlin, May, 1921. — III. *Mitteilungen der Vereinigungs, Deutscher Schweinezuchter*, Year XXVIII, No 5, pp. 93 95. Berlin, May, 1921.

I and III. — Tests with "Maismastfutter," a fattening food placed on the market by the "Bezugsvereinigung Deutscher Landwirte G. m. b. H. Berlin," consists of maize and fish meal residues.

It contains: 18.3-20.8 % crude protein: 5-6.2% crude fats; 45.5-54.4% non-nitrogenous extracts and 5.4-9 % crude cellulose.

Four young castrated Large Yorkshire males with an average initial live weight of 75 kg. were selected for the tests which lasted from 2 to 4 weeks (2 periods).

First period. — The pigs were fed for 4 weeks on a mixture composed of 1 kg. of "Maismastfutter" and 8 kg. of steamed and mashed potatoes (starch content 16 %).

This mixture, given cold to the pigs, was eaten in considerable quantities; thus 10.7 kg. of the mixture per head per day was ingested during the first week, 14.7 kg. during the last and, on the average, 12.6 kg. containing 1.75 kg. of "Maismastfutter" and 10.85 kg. of potatoes.

Second period. — The quantity of "Maismastfutter" in the mixture was increased; the mixture then consisted of 2 kg. of "Maismastfutter " and potatoes as required. On an average, 12.05 kg. of this mixture, containing 2 kg. of " Maismastfutter " and 10.05 kg. of potatoes, was consumed daily by each pig.

The average increment in weight during the 4 × 7 = 28 days was 25 + 24 + 23 + 31 = 103 kg. for the first period and 20 + 18 + 25 + 22 = 85 kg. for the second period, corresponding to an average increment of 920 and 760 gm. per head per day respectively.

The production of 1 kg. live weight corresponded to a consumption of 2.27 kg. of " Maismastfutter " and 12.51 kg. of potatoes. No unfavourable influence on the meat was noticed. " Maismastfutter " in conjunction with potatoes is a good food for fattening pigs.

II and III. — EXPERIMENTS ON FATTENING PIGS WITH SWEET MOIST LUPINS.

(A) *The concentrates usually used are replaced partly by sweet moist lupins* (1). — The experiments were made on 6 pigs 8 months old of improved country breed with an average live weight of 60 kg.; the test lasted 6 weeks. The pigs were given 1 kg. of crushed barley, 100 gm of fish meal, 500 gm. of serradella husks, and 1.15 kg. of sweet moist lupins, mixed with steamed potatoes, per head per day. The increase in live weight per head per day was 834 gm., so that the production of 1 kg. of live weight required 1.2 kg. of crushed barley. 0.12 kg. of fish meal, 0.6 kg. of serradella husks, 1.4 kg. of sweet moist lupins, and 12.1 kg. of potatoes.

The author compares the experimental data of the two tests with the results of the previous test (2) and observes that the increase in weight per day per head was equal in the three tests and, further, that the ration containing only a portion of the concentrates in the form of lupins, proved in no way superior to the ration in which the lupins entirely replaced the concentrates

(B) *Semi-sugar-beet as a substitute for part of the potatoes in the ration.* — The experiments were made on 24 pigs of which 21 were of large Yorkshire breed and 3 half-bred pigs of the cross Improved country breed × Local Hildesheim breed. The initial weight per head averaged 73 kg.

The pigs were divided into three lots and were given the following mixtures: —

Lot 1: — 16 kg. of potatoes, 16 kg. of semi-sugar-beet and 3 kg. of sweet moist lupins (equal to 1 kg. of dry lupins).

Lot 2: — 16 kg. of potatoes, 16 kg. of sugar-beet and 4.5 kg. of sweet moist lupins (equal to 1.5 kg. of dry lupins).

Lot 3: — 16 kg. of potatoes, 16 kg. of sugar-beet and 6 kg. of sweet moist lupins (equal to 2 kg. of dry lupins).

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(1) In the previous experiments the lupins entirely replaced the concentrates and were given mixed with steamed potatoes to the pigs. See *R.*, Feb. 1921, No 119. (*Ed.*)

(2) For the preparation of potatoes and lupins see *R.* Feb 1921. (*Ed.*)

The starch content of the potatoes was 14-16 % and the dry matter content of the sugar beet 15 %.

The tests lasted 8 weeks.

Quantities of food consumed by the 4 lots and quantities required to produce 1 kg. in live weight.

Lot	Food consumed	Mixture containing			Conversion of quantities of moist lupins into equivalents of dry lupins	Increase of weight per day per head	Quantities required for the production of 1 kg. of live weight			
		Moist lupins	Potatoes	Beet			Moist lupins	Dry lupins	Potatoes	Beet
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
1	17.07	1.465	7.802	7.802	0.488	0.619	2 36	0.786	12 60	12.60
2	15.53	1.912	6.809	6.809	0 637	0 507	3.77	1.257	13 43	13.43
3	16.54	2 611	6.965	6 965	0.870	0.591	4.42	1.473	11 78	11.78

It appears from this table that the mixture eaten by Lot 1 gave the best results and this stands out still more clearly when the return is calculated. The author explains this by the fact that the protein content of that ration (0.257) was just sufficient (corresponding to KELLNER'S figure, 0.255 kg.) whilst the mixture fed to Lots 2 and 3 contained an excess of protein which could produce no favourable effect.

Further, the author, comparing these results with those of the test made last year, notes that the feeding effect of the ration containing semi-sugar-beet is inferior to that of the ration containing potatoes and sweet lupins only.

The increase in weight of the pigs of different breeds cannot be compared as they were unevenly distributed in the 3 lots; however, the cross-bred pigs in Lots 1 and 3 showed a smaller gain in weight than the Yorkshires

A later experiment with purchased sweet lupins showed the necessity of using lupins sufficiently sweet for rational fattening of pigs. As the trade lupins were not sufficiently freed from their bitter properties, the pigs only consumed 7.12 kg. per day per head and gained an average of 0.289 kg. in live weight.

738 - **Note on a French Fish Meal.** (1) DAHL, E., in the *Annales de la Société des Sciences Naturelles de la Charente-Inférieure*, Nov 1920; reviewed in the *Bulletin de la Société Scientifique d'Hygiène Alimentaire et d'Alimentation Rationnelle de l'Homme*, Vol IX, No 2, pp. 102. Paris, 1921.

Meal made at the Aytré factory utilising fish unfit for human food, edible species of fish which are unsaleable, and the heads of large fish. They are placed in driers in which they are simultaneously cooked, dried and ground.

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(1) See *R.*, May 1921, No. 513 (*Ed.*)

After 4 hours an amber-coloured coarse powder containing quantities of bones, sharp bones and teeth, is taken out of the drier. This powder than passes into an electrically driven grinder, and is then sifted, reground, and again sifted very finely. The meal is then in the form of a yellow powder, smelling strongly of fish and having the following composition:— Protein 60 02 %; fats 9.68 %; mineral matter 18.90 %; moisture 14.40 %. The mineral matter contains:— Lime 7.60 %; phosphoric acid 7.08 %; sodium chloride 1.52 %. Its digestibility is 90 % and its nutritive value 72.9.

739 - **Correlative Variability in Domestic Animals.** — FEIGE, E., in *Landwirtschaft liche Zeitung*, Year 70, Nos. 3-4, pp. 61-69. Stuttgart, Feb. 1921.

Critical study of the method of calculating correlation from statistics of variations (1). The author explains that the biological conception of correlations does not agree with the usual procedure in the statistics of variations. Most comparisons between morphological characters, and between these and physiological characters, are not true correlations but functions of a third-degree magnitude that may give a positive or negative coefficient of correlation, which, on the contrary, does not enable a direct relationship to be deduced from it. All organs of an individual have, within their fixed limit of organisation, a deviation of variations, which is not in direct relationship of a correlative kind with all the other elements of the whole organism. All our calculations of variation are based on a supposititious average value of a series and correspond to that series, but for all that they are not expressions of an absolute fact and can only express a mathematical probability.

Consequently it is always possible from time to time to note that, in certain individuals, other bodily relationships appear, contrary to the average expectation.

Thus, it has been found, by calculation on 1828 Holstein cows ("Holsteiner Elbmarschkuh"), that regarding length of body, the "typical" average value was 159.973 cm., while the deviation of variation on this basis, accepting JOHANNSEN'S value $M \pm 30$ ($\varsigma = \pm 7.233$) varies between 138.304 and 181.624 cm. Actually there are variants above and below that deviation of variation which do not correspond in any way with the calculated type.

A single combination of the mathematical expressions of all the individual attributes might represent the bodily conformation of the maximum aptitude of a physiological attribute, such as the milking quality of an animal, but this method is not applicable, as a single extreme variant would upset the whole system of constancy of relationships, and also because each may constantly be displaced, so that it is impossible to find a standard generally valid for milk production by means of measurements and inspection of animals; that must be left to chance or zootechnical skill.

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(1) Method used by AUSTIN with the object of introducing exact methods in estimating the relationship between bodily conformation and aptitudes of animals.

E. AUSTIN: Körperform und Milchleistung, 33. *Flugschrift der Deutschen Gesellschaft für Züchtungskunde.* Berlin, 1915. (*Ed.*)

This statement is not affected by the fact that a marked diposition to produce milk may be associated with a certain type of conformation which from a zootechnical standpoint does not represent any improvement, either because variation and copulation may always create new types, or because quantitative researches of the kind of the statistics of variation extending over several generations and taking biological analysis into account have not yet been made for domestic animals.

740 – **On the Cross between Jersey and Dutch Black Piebald.** — VAN DER PLANCK, G. M., in *Genetica*, Part II, No. 4, p. 300. 'S Gravenhage, July, 1920.

The author's experiments, provide no confirmation for KUIPER'S statement that the product of the cross Jersey × black piebald (" Zwartbont Vee ") should be more or less spotted in the F_1 generation.

It is precisely the white marks which are reduced to a minimum. Only a small white spot on the belly was noted. The coat of the calves is of a tint slightly more dark brown than the typical coat of Jersey. The zone of light hair round the muzzle and on the forehead which is characteristic of Jerseys is wanting.

741 – **Note on the Cattle of French West Africa.** — *Revue Générale du Froid et des Industries Frigorifiques*, year II, Vol. II, No. 4, pp. 137 Paris, April, 1921.

It has been said that the cattle of French West Africa, are of inferior quality, but veterinary surgeons who have stayed in those regions affirm that there is no truth in the statement. The meat is of excellent quality, and the yield, judging from the weights of cattle from Kaolack, is similar to that of French breeds, as will be seen by Table I.

TABLE I. — *Yield of Kaolack cattle.*

Live weight	300 kg	Feet (live weight)	1.7%
Yield	49.5%	Raw tallow	2.0
Hide	7.0	Bone	17.0
Head	2.5	Meat net of the weight in quarters	33.0

TABLE II. — *Number of cattle.*

Senegal	800 000 head
French Sudan and Upper-Volta	1 800 000 »
Guinea	400 000 »
Mauritania	500 000 »
Total	3 500 000 head

These figures are much below the true ones and ought certainly to reach 5 millions, including the cattle of Togo, the Ivory Coast, and the Niger Territories; 120 000 bullocks are available annually. Since 1912, peripneumonia has made great ravages. The losses were often 50 % and over, the average loss being 30 %. Cattle plague has caused a loss of 350 000 head.

The numbers of sheep and goats are indicated in Table III.

TABLE III. — *Number of sheep and goats.*

	Sheep	Goats
Senegal	250 000	700 000
French Sudan and Upper-Volta	2 500 000	3 000 000
Mauritania	2 000 000	3 000 000
Guinea	800 000	1 000 000
Dahomey	150 000	200 000
Ivory Coast	400 000	200 000

Among measures indispensable to the development of the flocks and herds may be mentioned:— Organisation and development of the Veterinary Service; increase in the number of wells so as to reduce the long journeys to water which fatigue the cattle; the improvement of cattle by selection.

742 - **The Reconstitution of the Cattle in Friuli, Italy.** — MURATORI, M., in *L'Italia agricola*, Vol. 58, No 5, pp. 129-134, figs. 3. Piacenza, May 15, 1921.

From a cattle-breeding point of view the Province of Udine should be divided into 3 regions:— 1) The mountains, where mountain breeds for milk production are kept; 2) the hills and the plains of middle and lower Friuli, where a local piebald breed is kept mainly for meat but also for milk and for work; 3) the hills and the plains of Western Friuli where is kept the grey breed in which aptitude for work while predominant does not exclude aptitude for the production of milk and meat (1).

According to data collected by Dr. P. ZANETTINI, ex-secretary of the Provincial Zootechnical Council, the total number of cattle, when the Province was invaded, was 216 000 head, of which only 19.5 % remained, that is to say about 42 100 head of cattle distributed as follows:—

13 500 in the mountains	against	48 000	before	the	invasion
23 000 in middle and lower Friuli	»	129 000	»	»	»
5 600 in western Friuli	»	39 00	»	»	»

Of the cattle left 85 to 95 % were cows. In the two years 1919 and 1920, private persons and the "Consorzio zootecnico provinciale" introduced about 52 000 cows and 10 000 bullocks into the Province of Udine; about 4000 of these cattle died of foot and mouth disease and a good part of the imported cows had to the replaced on account of permanent barrenness. Brown cattle chiefly were sent to the mountains; to hills and plains animals of northern Italian breeds were sent indiscriminately.

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(1) Detailed information regarding the distribution of breeds of cattle in Friuli will be found in a Report by M. MURATORI published by the "Commissions di studio per la ricostituzione agraria delle terre invase." Rome, L'Union Editrice, 1919. See also *R.*, March 1921 No. 318; April, 1921, No 358. (*Ed.*)

The Zootechnical Commission, on recommencing work in the spring of 1919 proposed specially to re-establish the red piebald breed in middle and lower Friuli and the grey breed in western Friuli and to proceed with the gradual diffusion of the brown breed in the mountains, except for the Canal del Ferro and a few communes of the districts of Gemone (a land too poor for this breed), where it is proposed to reconstitute the small local red piebald breed, an offshoot of the Mölthal breed which is found in many of the alpine provinces of Austria. As the acquisition of such cattle in Austria presented difficulties, recourse was had to the Valdostana red piebald breed, akin to the Friuli breed.

In 1919, 350 bulls for public service were approved (about 60 % of the number which existed in 1916) distributed as follows: —

145 red piebald breed in middle and lower Friuli.
42 grey breed in Western Friuli.
123 brown breed in the Carnic Alps and Prealpes and in the mountain communes of the districts of Tarcento and Cividale.
40 Valdostana and Mölthal breeds in Canal del Ferro and in the mountain communes of the districts of Cremona.

The number of cows existing in the Province in 1919 represented about 60 % of the number in 1916, that is to say 70 000 as against about 120 000.

In 1920, the Zootechnical Commission placed 130 more young bulls, namely 13 Valdostana, 40 brown, 62 piebald and 15 grey, distributed in the regions mentioned above against each of these breeds. The number of approved bulls for public service was 462, or about 90 % of the number in 1916.

On the whole work accomplished by the Zootechnical Commission in 1919-1920 a total of 400 000 *lire* was spent, almost entirely used in the purchase and maintenance of the stud bulls.

In conclusion, the author outlines the programme of future work for restoring the cattle throughout the geographical area of each breed.

743 - **The Marsh and the "Procoio Bufalino" (1) in the Province of Rome, Italy.** — BIANCHINI, B., in the *Rivista Agricola Romana*, Vol. XLVII, No. 5, pp. 120-128. Rome, May, 1921.

In the low Maremma of Latium and in the Pontine Marshes buffaloes are bred on a large scale, making use of marsh land on which no other animals could live and which cannot be cultivated under any crop. The two principal centres of buffalo breeding are situated, one at Maccarese (Roman Campagna), the other, much more important, at "Foce Verde" in the commune of Cisterna. In that stretch of marsh and forest the buffalo gives a high return as the very inferior forage provided by the marsh grass suffices and the animals do not require any particular care while they furnish very rich milk, can be used for any kind of agricultural work and, like the ox, can finally be sent to the butcher. The idea that buffaloes give little profit is absolutely unfounded and it is a pity that their improvement has been neglected.

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(1) "Procoio bufalino" = buffalo breeding farm. See *R.*, May 1921, No. 536 (*Ed.*)

Full grown buffaloes weigh from 4 to 5 quintals; the males reach even 7 quintals and over They are therefore fairly good animals for meat production; the meat, although darker in colour than that of oxen and cows and of a coarser grain, is just as wholesome.

Buffalo calves are reared exclusively on milk for the first 2 months and partly on milk until they are 8 months old. The second period is necessary, so that the cows may be milked as they will not give milk unless they are under the illusion that they are suckling their calves. This is the reason for the very original method of milking which is done at fixed times, generally 4 o'clock in the morning and 4 o'clock in the afternoon: At milking time the cows are collected in a " rimessa " (railed-off area) and the calves in a " rimessino " opposite; the " bufalari " provided with pails, are stationed between the two enclosures with the " paravanti " whose business is to keep the cows in order with their sticks. A " bufalaro " calls a cow by name; the calf, which has already learned to recognise its mother's name begins to low and comes to the rail of the " rimessino. " A man lets it out; the cow comes into the central space and the calf begins to suck. As soon as the cow begins to suckle the calf the latter is driven off by a blow of a stick on its muzzle and its place is taken by the " bufalaro " who starts milking. The cows after having been milked are driven into a " rimessino " apart, where are also driven the calves which, a short time before, had been prevented from sucking and which are now allowed to suck the small amount of milk that remains

With the buffalo milk various delicious milk foods are prepared, such as :— " provature, " " mozzarelle, " " marzoline, " " provoloni, " " uova di bufala " (buffalo eggs), " abote. "

The buffalo is wild and suspicious, but obedient to the orders of the " bufalaro, " the only person it obeys. They are stronger than oxen. In Latium they are yoked, and are well suited to drag very heavy loads over difficult roads.

Owing to the fact that buffaloes stay willingly in the water and do not suffer from rheumatism they are used for clearing the drainage canals in the marshy zones, which, having little or no slope, easily become choked by thick vegetation. Herds of buffaloes driven by the " bufalari " into the canal so as to occupy its whole width uproot the subaqueous bushes by the alternating movement of their powerful hoofs.

The " bufalari " go in small canoes, one in front of the buffaloes and two others behind them. Twenty four hours after their passing, the level of the water in the canals has sensibly fallen. The work done by the buffaloes is much more effective than that done by an underwater scythe, because the plants are uprooted.

The method of rearing buffaloes in the Roman Campagna is similar to that adopted for cattle (1). As a rule, castrated buffaloes and cows are kept on the farm until they are 12-16 years old when they are fattened for slaughter. The hides of these buffaloes are used in the manufacture of "soatto," the white leather from which the harness and special footwear, called "ciocie," used by the country people in the districts of Frosinone and Velletri are made.

With the horns are made various toilet articles, etc.

The author recommends:— 1) The selection of buffaloes so as to increase the dairy produce; 2) taming, so that more animals may be used on agricultural work for which they are marvellously suited; 3) the introduction, at least on a small scale, of stall rearing in localities near rivers.

744 - **Studies Made in the United States Concerning Variations in Length of Gestation Period and Other Factors with Special Reference to the Birth Weight of Pigs.** — CARMICHAEL, W. J., and RICE, J. B., in *University of Illinois, Agricultural Experiment Station, Bulletin* No. 226, Tables 22. Urbana (Illinois), May, 1920.

These records include 720 litters containing 5840 pigs, and were made during the years 1903 to 1916 inclusive under the management of the Animal Husbandry Department of the University of Illinois. The records are based on the influence of the following factors: 1) Length of gestation period; 2) size of litter; 3) age of dam; 4) breed; 5) time of year; 6) order of farrowing; 7) succeeding litters from the same sow.

1) LENGTH OF GESTATION PERIOD. — The records obtained from 549 litters, showed a somewhat wide range, 98 to 124 days, in the length of gestation period with an average of 114.58 days. However, 93.6 % of the litters were farrowed between the 111th and 119th days, and 73.8 % between the 113th and 117th days.

Although there may be a slight variation in length of gestation period due to age (see Table I), the general belief that older sows have a gestation period one to three days longer than younger sows seems to have no very sound basis.

There was a negligible, if any, correlation between the length of gestation period and the birth weight of pigs, but there was a tendency for some of the litters, which were carried longer than the average, to be smaller than those which were farrowed earlier than the average.

A study of the sex of the pigs in relation to the length of gestation period, shows no apparent tendency for either sex to predominate.

2) SIZE OF LITTER. — In this study the average size of litter was 8.1 pigs. The average weight of a litter is about 20 lb. This weight varies almost in direct proportion to the number of pigs in the litter.

The average weight of pigs in litters with fewer pigs than the average was 2.67 lb., and in litters with more pigs than the average it was 2.47 lb.

There is no noticeable correlation between size of litter and sex. It is, however, interesting to note that in a total of 5 657 pigs, 51.9 %

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(1) See *R.*, May 1921, No 536. (*Ed*).

TABLE I. — *Relation of age of dam to length of gestation period.*

Age of dam (years)	Length of gestation period (*days*)																				Total number of sows of each age	Average length of gestation for sows of this age (*days*)
	98	102	103	106	107	108	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124		
1	—	—	—	1	1	1	2	3	14	11	20	21	25	12	5	2	1	—	—	—	2	121	114.71
1 1/2	—	—	1	1	—	1	2	3	7	8	25	16	16	14	3	1	—	—	—	—	—	98	114.44
2	—	1	—	1	—	—	1	3	12	18	21	22	11	7	5	3	1	—	—	1	—	107	114.37
2 1/2	1	—	—	—	—	—	1	3	1	8	11	16	9	1	2	2	1	1	—	—	—	57	114.51
3	—	—	—	—	1	—	2	1	4	12	10	4	10	4	3	—	—	—	—	1	—	52	114.37
3 1/2	—	—	—	—	1	—	1	1	—	3	9	5	4	1	2	—	—	—	—	—	—	28	113.68
4	—	—	—	—	—	—	2	2	3	6	—	4	8	8	3	—	1	—	—	—	—	37	114.87
4 1/2	—	—	—	—	—	—	—	—	—	1	3	2	4	4	—	1	—	—	—	—	—	15	115.73
5	—	—	—	—	—	—	—	—	3	—	2	1	2	1	1	—	—	1	—	—	—	11	115.18
5 1/2	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	2	114.50
6	—	—	—	—	—	—	—	—	1	—	2	—	2	—	—	—	—	—	—	—	—	5	114.40
6 1/2	—	—	—	—	—	—	1	—	—	—	—	—	1	2	—	—	—	—	—	—	—	4	115.00
7	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	115.00
Unknown	—	—	—	—	—	—	—	—	1	—	1	—	3	1	4	—	—	—	—	1	—	11	116.91
Total	2	1	1	3	3	2	12	16	46	68	104	92	96	55	28	9	4	2	—	3	2	549	*Av.* 114.58
Average age (sows of known ages).	3.00	2.00	1.50	1.50	2.50	1.25	2.79	2.22	2.13	2.35	2.17	2.13	2.38	2.46	2.39	2.11	2.38	3.75	—	2.50	1.00	2.28	

	Average age of sows farrowing on or before the 114th day, 2.24 years (256 litters).	Average age of sows farrowing after the 114th day, 2.31 years (282 litters).	

were males and 48.1 % females. The litters larger than the average contained 10.5 % dead pigs, and the litters smaller than the average, 7.7 %. The proportion of males (56 %) among those farrowed dead was greater than the normal predominance of males over females.

3) AGE OF DAM. — On the whole, the belief that young sows produce smaller pigs than the older sows has been confirmed by these researches. The average number of pigs from sows 1 to 1 ½ years old was 7.5, and from sows 2 years old or more, 8.6, with average weights of 2.44 lb., and 2.61 lb., respectively. The older sows therefore farrowed a greater percentage of dead or immature pigs than the younger sows. The age of the sow appeared to have no effect on the proportion of males to females.

4) BREED. — Somewhat wide differences appear to exist among various breeds as to the length of gestation, size of litter, and birth weight of pigs. Berkshires had appreciably the longest gestation periods (115.4 days).

Results obtained in the experiments under consideration are shown in the Table on p. 885.

5) TIME OF YEAR. — Results lead to the conclusion that it is very doubtful whether any variations exist in farrow which can be attributed to the season.

Breed	Average age of dams *years*	Average length of gestation *days*	Number of litters	Number of pigs	Number of pigs per litter	Total weight lb	Weight Average weight per litter lb.	 Average weight per pig lb.
Berkshire	2.42	115.2	235	1 744	7.42	4 543.6	19.3	2.61
Chester White	2.52	113.1	29	278	9.59	719.0	24.8	2.59
Duroc-Jersey	2.04	113.1	57	498	8.74	1 122.0	19.7	2.25
Hampshire	2.75	112.5	2	14	7.00	35.0	17.5	2.50
Poland China	2.34	114.6	47	309	6.57	773.5	16.5	2.50
Tamworth	2.28	114.2	23	217	9.43	560.1	24.4	2.58
Large Yorkshire	2.85	113.5	24	278	11.58	722.2	30.1	2.60
Crossbred	1.93	114.0	40	320	8.00	780.1	19.7	2.44
	2.35	**114.5**	**457**	**3 658**	**8.00**	**9 261.8**	**20.3**	**2.53**

6) ORDER OF FARROWING. — Of the first farrowed, the proportion of males (59.4 %) was higher than the normal ratio of males to females. In comparing the averages of the same sex, as well as that of both sexes, it was found that the average weight of the former was somewhat heavier than the average of the latter.

7) SUCCEEDING LITTERS FROM THE SAME SOW. — In most cases, there was an increase in the number of pigs per litter and in the weight of individual pigs until the fourth litter, at which time the sows were 3 ½ years old. However, attention is drawn to the fact that to obtain the maximum and economical production, other factors than the number of pigs and their size should determine the age at which sows should farrow the first and succeeding litters.

[744]

745 - **The Present Position of Poultry Keeping in German Austria.** — WIENINGER, in the *Deutsche landwirtschaftliche Geflügelzeitung*, Year XXIV, No 26, pp 591-594 Berlin, March, 1921

The author shows, by the aid of statistics, that the customs receipts of the former Austro Hungarian Monarchy, so far as poultry and their products were concerned, were attributable less to well-developed poultry keeping with judiciously adapted methods than to the very extensive transit trade of poultry and their products originating in Russia and the Balkans and to the very restricted consumption, averaging 46 eggs, per inhabitant per annum, The production in the country itself was only 46 % of the total export.

Since the fall of the monarchy, the conditions of poultry keeping in German Austria have changed considerably, in as much as the scarcity has inevitably led to an extension in keeping poultry, to which must be added an increasing tendency to keep hens of selected breeds This interest in the keeping of special breeds of poultry is at present encouraged by the creation of numerous breeding Stations ("Zuchtstationen") or breeding farms ("Zuchthöfe"), composed of the best poultry farms possessing a number of good cocks and hens for breeding, which should be used for distributing the greatest possible number of young poultry selected with a view to good laying power. All the sitting eggs supplied by these stations are incubated in 24 industrial establishments and 304 incubation stations which now possess incubators with a total capacity of 200 000 eggs.

Of all the countries in German Austria, Lower-Austria has most poultry, but for hens it is beaten by Upper-Austria with 1-5 hens per inhabitant or 1.9 per hectare of cultivated land. The present production in these districts, owing to their mountainous character and also to the fact that the farms are chiefly in the hands of peasants, is not more than 70 eggs per hen per year

The total production is 248 736 180 eggs, a number which will not long suffice to meet the requirements of German Austria, the demand being for 736 748 160 eggs, so that there is a deficit of 488 011 980 eggs

The distribution of the poultry among the different regions is indicated in the Table. on p. 888.

The author considers the possibility of increasing the production of eggs and the number of hens and concludes that any considerable increase in production is unobtainable, owing to the lack of food, and that the best way of increasing the number of eggs, which are necessary for feeding purposes and especially Vienna, is a wide spread use of artificial incubation.

Regarding the increase of the number of hens, Carinthia, the Tyrol, Salzburg and Vorarlberg, which are for the most part mountainous, can only bear a very slight increase. Besides, in those countries the keeping of ducks for laying is making progress, ducks being specially prized on account of their resistance to inclement weather, their small consumption of grain and also for their habit of commencing to lay very early in the winter.

Number of poultry in Austria, present production of eggs and number of eggs required for consumption.

Country	Number according to the census of Dec. 31 1910				Cultivated Area	Number of inhabitants	Number of hens		Number of eggs required for a normal consumption of 120 eggs per inhabitant	Present production of the hens at 40 eggs per year	Deficit
	Ducks	Geese	Other poultry	Hens	(hectares)	on 1920 June 30	per inhabitant	per ha.			
Vienna (city)	157	275	866	68 836	7 877	1 842 005	0.04	8.7	221 040 600	3 212 300	217 828 300
Lower Austria.	22 838	39 966	122 609	2 167 346	1 141 905	1 471 150	1.4	1.8	176 538 000	101 142 720	75 395 280
Upper Austria	9 630	5 927	117 183	1 292 916	672 177	857 234	1.5	1.9	102 868 080	60 336 080	42 532 000
Styria	13 277	9 244	46 470	982 111	663 863	946 721	1.0	1.4	113 606 520	45 831 800	67 774 720
Carinthia	2 257	1 128	4 514	315 979	451 399	369 395	0.8	0.6	44 387 400	14 745 640	29 581 760
Tyrol.	1 038	3 114	3 633	260 929	519 098	306 153	0.8	0.5	36 738 360	12 176 640	24 561 720
Salzburg	925	844	5 555	150 760	363 425	213 877	0.7	0.4	25 665 240	7 035 420	18 629 820
Voralberg	612	138	566	91 190	160 253	133 033	0.6	0.5	15 963 960	4 255 589	11 708 380
Austria . .	**50 734**	**60 636**	**304 396**	**5 330 067**	**3 979 997 ha**	**6 139 568**	**0.8**	**1.3**	**736 748 160**	**248 736 189**	**488 011 980**

The very developed river system provides extremely favourable conditions for keeping ducks. Pekinese ducks and runner ducks give very satisfactory results in these conditions and produce 100-120 and 150-160 eggs respectively.

746 – **Supplementary Note on Bee keeping in Morocco.** — JEAMMET, in *L'Apiculteur*, Year LXV, No 4, pp 94-95 Paris, April 1921

Infomation supplementing a previous account of bee keeping in Morocco (1). The author names some honey-bearing plants not given in his previous account, viz :— Cactus, Viburnum, Aloes, Asphodel, giant Cow-parsnip of the Caucasus or Heracleum; he proceeds to give the period and duration of flowering, the distribution of the principal melliferous plants, and furnishes some data relating to methods to be followed. Owing to the diversity of the climate, according to the altitude, and varying from the coastal region to the interior, methods have to be modified and lessons have to be learned from native practices. Thus, in the various regions of the Atlas (Middle-Atlas), the region of the Entifas or in the Souss, the hives are inside the kasbahs so as to protect the bees from the extreme temperatures which occur there :— 60°C in summer and –10°C, in winter in the Atlas.

In the regions of Casablanca, Meknès, Fez, the Dadant hive and the like give good results , in the hottest parts of the interior precautions have to be taken to prevent the wax melting in summer. In the Zaer districts, forest of Mamora, the native uses a hive about one metre long, made of the bark of the cork-oak which the bees like particularly on account of the non-conducting properties of the cork which shields them from the external temperatures. This hive is placed horizontally on the ground. This is also the position of other hives made of reeds plastered outside with mud.

At present, bee keeping in Morocco cannot be considered possible as the sole occupation, but it would be an appreciable auxiliary industry connected with a farm, especially where care is taken, when planting fruit trees or ornamental shrubs, to select those species which also produce nectar, e. g., the Judas tree, Robinia, *Grevillea robusta*, *Budleya*, and *Mioporum*.

747 – **The Saharan Bee.** — BALDENSPERGER P J , in *The British Bee Journal*, Vol XLIX, No 2031, p 235 London, May 1921

This bee found only south of the Atlas on the Saharan declivity is very rare in the places visited by the author. It resembles very much the Cyprian both in colour and in the well-marked crescent of a golden tint at the base of the thorax. The drones are rather darker with a few but very narrow bands.

The colour of the queen as seen by the author was of a dull yellow hue ; invariably the last ring of the abdomen is quite black while the next one is half black.

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(1) See *R* May 1920, No 565 — Also see *R*. April 1919, Nos 413 and 498. (*Ed.*)

The bees are a little larger than the ordinary black bee of North Africa known under the name of " Kabyle " or Algerian and " Punic, " but the author considers the most appropriate name to be " Tellian " which thrives all along the Mediterranean coast from Tunis to south of Modagor, and inland up the Atlas to the limit where bees can thrive.

There is a sterile or half-sterile tract of country known as Hauts-Plateaux or Région des Steppes something over 200 km., in breadth, all over Algeria and part of Morocco of the Great Atlas serving as a strict separation between the two races of bees, yellow and black. The limit of the Saharan bee was found to be at Aïn-Sefra. The bee was first noticed by BERNARD of the Société des Apiculteurs Algériens. As regards its existence there the author considers the hypothesis plausible that the bees were probably imported into the Southern Atlas, then densely wooded, by Jewish settlers or persecuted tribes in the first century

748 - **The Mite *Tarsonemus woodi* Causal Agent for the Isle of Wight Disease in Hive Bees.** — I. *Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 1, pp. 78-81. London, April 1921. — II. *The British Bee Journal*, Vol. XLIX, No. 2037, pp. 185-187. London, April 1921. — III. IMMS, A. D., in *Nature*, Vol. CVII, No. 2687, pp. 283-284. London, April 1921.

Investigations carried out at Aberdeen University by Dr. J. RENNIE (1) and his co-workers have demonstrated that the Isle of Wight disease and the disease caused by *Nosema apis* (2) are two quite distinct diseases. The causal agent of the Isle of Wight disease may be attributed to a mite of the genus *Tarsonemus* hitherto undescribed and named by RENNIE *Tarsonemus woodi*.

This parasite was observed first in December 1919 in a single example from a colony showing no signs of disease The symptoms were as follows :— Listlessness of the bees ; dislocation of one or both posterior wings, and distention of the abdomen ; the staining of the alighting board and combs with excreta of the consistency of putty ; crowding of the bees on the outside of the hive and in severe cases owing to their inability to fly crawling about in thousands on the ground or ascending upright objects, and at times collecting in small clusters eventually to die.

The mite occurs only in that part of the tracheal system which is connected with the anterior thoracic spiracle. All stages of the Acarine were found together (eggs, larvae and adults) which when present in large numbers entails the obstruction of the tracheae of the thorax, either partially or wholly, which leads either to sudden death or inability to fill the air sacs which permit of flight, and reduces the bees to crawling.

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(1) See *R.*, Oct-Dec., 1919, No. 1211. (*Ed.*)

(2) Isle of Wight Disease in Hive Bees ; 1) " The Etiology of the Disease " by D. J. RENNIE, P. R. WHITE, and ELSIE J. HARVEY (pp. 737-758) ; 2) " The Pathology of Isle of Wight Disease in Hive Bees, " by P. B. WHITE (pp. 756-764) ; 3) Isle of Wight Disease in Hive Bees — Experiments on Infection with *Tarsonemus Woodi* n. sp., by ELSIE J. HARVEY, (pp. 765-767) ; 4) Isle of Wight Disease in Hive Bees, Acarine Disease : The Organism Associated with the Disease — *Tarsonemus Woodi*, n. sp. by Dr. J. RENNIE (pp. 768-769) pl. 1, figs. 2). — *Transactions of the Royal Society, Edinburgh*, Vol. LII, Pt. IV, No 29. Edinburgh, 1921.

In studying the pathology of the disease P. B. White points out that the mites perforate the tracheae and live on the body fluids of their hosts; the tracheae become darkened and ultimately black by the increasing deposition of chitin. In the examination of 250 stocks from different parts of the country, the parasite was discovered in all of them. Of 140 stocks, believed by the owners to be healthy, 50 (nearly 36 %), harboured the parasite *Tarsonemus woodi,* but *Nosema apis* was not always present.

Except in one doubtful case the brood was not found infected; the queens usually survive until the colony becomes extinct.

The usual symptoms of the disease have been produced artificially by blocking up the thoracical spiracles of the bee with wax. Many bees from different countries outside Great Britain have been examined and so far *Tarsonemus woodi* has not been found.

Dr. Rennie suggests that the name Isle of Wight disease should be changed to Acarine disease. Investigations connected with the appropriate control methods to be employed are in hand.

749 - **Experiments in Breeding and Feeding Silkworms in West Prussia.** — Lucks, R. (1), in *Biedermanns Zentralblatt,* Year XLIX, No. 5, pp. 190-196. Leipzig, May 1920.

As Director of the sericultural Station recently created by the "West-preussische Seidenbau-Studiengesellschaft" (West Prussian Society for sericultural study), the author, in 1917, proposed to establish a large breeding station of 30 000 silkworms. In these experiments in breeding silkworms in successive batches, owing to difficulties that caused considerable delay, the first worms were not hatched out until early in August. Between August 4 and 14, 9000 silkworms were hatched so that an experiment with 10 batches of 1000 silkworms in each could be started. The food consisted of mulberry leaves. Along with this experiment, a small comparative feeding test was arranged; 4 series of 390 silkworms in each were formed and fed as follows:—

Series I. — Mulberry leaves (M).
Series II. — Leaves of Viper's-grass (*Scorzonera hispanica*) (S).
Series III. — Mixture of leaves of mulberry and Viper's-grass (M. S.)
Series IV. — Mulberry leaves up to the fourth stage and leaves of viper's-grass during the fifth stage.

The experiments have shown that, in good conditions, the silkworm in West Prussia can be fed without risk up to the middle of September, since good mulberry leaves can be gathered up to that date, especially when it is considered that the best silk is obtained by feeding the silkworms on healthy full-grown leaves during the later stages.

In the experiment of breeding in successive batches, feeding with mulberry leaves, the period of growth of the silkworms was prolonged by

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(1) *Bericht der Westpreussischen Seidenbau Studiengesellschaft, Versuchsstation Danzig.*

11 to 15 days; the weight of 7500 cocoons collected between September 17 and the end of the month amounted to 8.56 kg.

The comparative feeding experiments gave the following results:—

I. — FEEDING WITH MULBERRY LEAVES. — The growth of the silkworms was satisfactory. The first change commenced on August 10, the second on August 16, the third on August 21, and the silkworms began to form cocoons on September 8, so that on September 17 all the silkworms had pupated. No diseased silkworms were seen.

II. — FEEDING WITH LEAVES OF VIPER'S-GRASS. — A number of silkworms refused this food; altogether 21 % died. The beginning of moulting took place at the same time as in the first series for some of the silkworms but did not follows the same regular course. Moreover the commencement of pupation was irregular, but 60.3 % of cocoons were formed.

III. — FEEDING WITH THE MIXTURE OF LEAVES OF MULBERRY AND VIPER'S-GRASS (the chopped leaves were so treated that the sap from the two kinds was mixed to prevent the silkworms from choosing between them). — The food seems to have been eaten without difficulty. After the third change, the leaves were given alternately and unchopped. The consumption was regular at first but after the 4th change the leaves of viper's-grass were refused.

The formation of cocoons was delayed in a curious manner. On September 13 (38th day), 41 % only of the cocoons were finished; the maximum, 90 % of cocoons, was reached in September 16 (42nd day).

IV. — FEEDING WITH MULBERRY LEAVES UP TO THE FOURTH STAGE AND WITH LEAVES OF VIPER'S GRASS DURING THE FIFTH STAGE. — In spite of a prolonged fast, the worms refused the new food and had again to be fed on mulberry leaves.

The weights of the cocoons formed by the different series were as follows:—

100 cocoons of Series I and IV (M)	149	grammes
100 cocoons of Series II (S).	118	»
100 cocoons of Series III (M. S.)	157	»

The cocoons (dark yellow in colour) of series II were, on the average, larger, but on the whole weaker than the other cocoons. The cocoons of series III were the strongest and in point of size occupied a medium position. The moths from the silkworms fed on leaves of viper's-grass were darker in colour, and pairing and laying were done in a hesitating manner. Regarding the tenacity and elasticity of the silk, it was found that the silk made by the silkworms fed on mulberry leaves + leaves of viper's-grass differed but little from the silk made by the silkworms which had been fed on mulberry leaves only.

The author next selected a certain number of cocoons from the two experiments, for eggs.

The moths hatched from them were paired as follows: —

S ♀ × S ♂ — M ♀ × S ♂ S ♀ × M ♂ M S ♀ × M S ♂ — M ♀ × M ♂.

[749]

The eggs were collected separately. The silkworms hatched from these eggs, as well as some silkworms hatched from Hungarian eggs, were again fed on the leaves of viper's-grass. After the fourth stage the silkworms from the Hungarian eggs commenced to languish and, from May 6, dead silkworms had to be removed daily. The silkworms produced by the various pairings remained healthy up to May 20, but after that date they also died in large numbers. These experiments were repeated twice more. The results may be summed up as follows:—

The silkworms fed only on leaves of viper's-grass up to the time when they commenced to form cocoons, produced cocoons which were of little or no use; even when this substitute was only given up to the third stage the yields were not satisfactory. A yield of 55 % can be obtained by feeding with leaves of viper's-grass up to the third stage, and then replacing them by mulberry leaves.

When silkworms are reared industrially the latter method has small advantage, since it is especially during the fifth stage, when a large consumption of food takes place, that feeding with the leaves of viper's-grass as a substitute for mulberry leaves would have most value. The author, however remarks that for the creation of a family silkworm that would consume leaves of viper's-grass right up to the forming of cocoons, feeding with that substitute from the commencement up to the third stage might be of great importance; the silkworms hatched from eggs laid by the survivors would eat the leaves of viper's-grass with less repugnance and become accustomed to it from generation to generation (1).

The author emphasises the great advantages of breeding the silkworms in successive batches, a method which is much less liable to unforeseen accidents, owing to which the ordinary method of breeding generally fails; this has been shown by an experiment in breeding silkworms in successive batches in 1918, when the leaves of the mulberry were for some time lacking, and when, therefore, in the meanwhile leaves of viper's-grass could be given without fear of loss. Another advantage of this method is an even distribution of work.

750 – **Action of Concentrated Sulphuric Acid on the Eggs of *Bombyx mori*** (2). — LÉCAILLON, A., in the *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 172, No. 11, pp. 718-721. Paris, March 14, 1921.

Fairly numerous researches had previously been made regarding the action of concentrated sulphuric acid both on fertilised and unfertilised eggs of *Bombyx mori*. It appears from the work of DUCLAUX (1876) and other writers that if the fertiliser eggs of univoltine varieties are submitted to that action for 1 or 2 minutes, just after they have been laid, they behave like the summer eggs, that is to say they produce silkworms at the end of 10 to 12 days, instead of producing them at the end of 9 or 10 months. But, on this point, some reservation is necessary since: — 1) Univoltine varieties fairly frequently give birth in a natural manner after 10 or 12 days, to casual bivoltine individuals; 2) the action in question appears to be inconstant.

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(1) F. LAMBERT, Director of the Montpellier Sericultural Station, in his publication *La scorsonère dans l'alimentation du ver a soie du mûrier*, Paris, 1916, "Bureau de Revue de Viticulture," passing in review works on the substitutes for the mulberry and, using his own experiments as basis, arrives at the same conclusions and further remarks, that the results might perhaps even be practically applied in countries where climatic conditions are adverse for growing mulberry trees for silk production. See *R.*, Dec. 1917, No. 1195. (*Ed.*)

(2) See *R.*, Jan. 1918, No. 75; *R.*, May 1919, No 627; *R.*, July-Aug. 1920, No. 786. (*Ed.*)

In the course of researches made during the past 7 years, the author has made a series of observations on this subject from which he draws the following conclusions:—

1) It is true that the immersion of unfertilised eggs of *Bombyx mori* in concentrated sulphuric acid has an influence on certain of them which do not change their colour naturally. However, that influence affects not only freshly-laid eggs but also much older eggs (at least 20 to 25 days old). The aptitude for parthenogenesis persists therefore for a long time in eggs which have apparently remained in the condition in which they were laid.

2) In the conditions of concentration, temperature and time in which it acts on unfertilised eggs, concentrated sulphuric acid has no action on fertilised eggs whether freshly laid, laid 18 hours previously or laid 5 to 7 months previously.

3) When they are immersed in the sulphuric acid *Bombyx mori* eggs lose their yellow colour. It appears that the chorion undergoes some modification in structure and becomes more opaque. This fact would seem to support the theory of LOEB (1) However, it is not proved, that traces of sulphuric acid cannot penetrate into the vitellus and play the part attributed by DELAGE and GOLDSMITH, or some similar rôle to that of catalysts.

FARM ENGINEERING

751 – **Operating the Tractor Plough** (2). — REED C. O., in *Farm Implement News*, Vol. 42, No. 5, pp. 46-49 and 74, figs. 3. Chicago. Feb. 3, 1921.

The discussion is confined to ploughs of the two, three, and four bottom unit lift gangs type, though many of the principles are equally applicable to both these and the independent lift gangs also employed.

The true line of pull in a double drive wheel tractor may be considered to pass midway between the drivers as shown in Figs. 1 and 2. If the tractor has only one driving wheel or drum, for all practical purposes the true line of pull passes through the centre of that driver, and the true line of draft of small engine gang containing an odd number of bottoms passes through the centre of the middle beam (Fig. 1) or when containing an even number of ploughs, between the two middle beams (Fig. 2). An ideal working condition should therefore allow the true line of pull of the tractor to coincide with the true line of draft of the plough. In many outfits, however, this is not possible, because the tractor and the plough must each be run in a certain fixed relation to the open furrow, and their widths may not be such as to allow this coincidence of the lines of pull and draft. In such cases side draft to some extent is bound to occur either in the tractor or plough or both, according to the hitch.

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(1) According to LOEB (1911) the action of sulphuric acid renders the membrane of the egg more permeable to oxygen. In his theory, aimed at explaining the experimental parthenogenesis, that writer assigns an important part to the phenomena of oxidation which are produced in the egg when the embryo begins to develop. According to DELAGE and GOLDSMITH on the other hand, it is the "dehydrating and caustic" influence of the acid which is the cause.

(2) Complete revision of former article on the Tractor Plough by the same author. See *R.* June, 1917, No. 575. (*Ed.*)

The method of procedure advised is as follows: — At the beginning of the second trip around new land, the tractor should be placed as near the open furrow as it is safe to run it, or actually in the furrow and the plough arranged carefully in its proper relation to the furrow. With a scratch of 2 marks on the drawbar of the tractor, — one to show the position of the true line pull, and the other to indicate where the true line of draft of the plough would cut the drawbar if extended ahead. The hitch bars from the plough to the drawbar of the tractor should then be attached at a point about midway between these 2 marks.

The sidedraft of the outfit will then be fairly well divided between the tractor and the plough.

Fig. 1 shows this condition with a 3-plough tractor when it has both drivers running on the unploughed ground. The true line of pull is on the left of the true line of draft. Fig. 2 shows a condition where a narrower, 2-plough tractor is running with one driver in the open furrow. The true line of pull is here on the right of the true line of draft.

With the hitch bars thus adjusted, the outfit should be started. If the side draft in the tractor proves troublesome, more of the sidedraft should be thrown on to the plough by removing pin *A*, and moving the clevis to the left on the drawbar of the tractor (Figs. 1) or to the right, (Figs. 2), thus attaching the load to the tractor nearer its true line of pull. Pin *A*. should then be replaced in the nearest hole in the hitch bars.

The fact that the sidedraft can be shifted at will from tractor to plough is important from the point of view of steering difficulties and plough troubles.

In making hitch adjustments to shift sidedraft, great care must be exercised not to destroy the proper width of cut of the front plough bottom, otherwise there results an uneven height of furrows. The cut of the front bottom should not be more or less than 14 in. for a 14 inch gang or 12 in. of a 12 inch gang.

If cutting too wide (Figs. 1) any one of 3 adjustments can be used to remedy the trouble: *a*) move the hitch clevis to the right on the drawbar of the tractor; *b*) move both hitch bars an equal amount to the left on the horizontal clevis on the plough beams; *c*) lengthen the right hitch bar in respect to the left by moving the latter forward at *A* one hole on the right bar. If the front plough is to be shifted to the right only an inch or two,

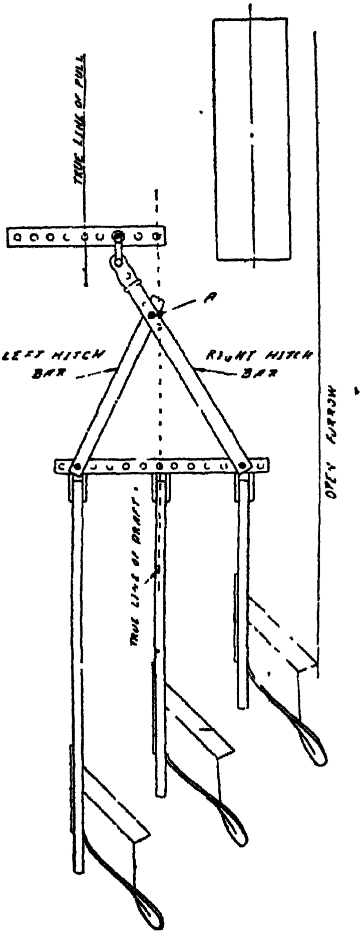
TRUE LINE OF PULL
A
LEFT HITCH BAR
RIGHT HITCH BAR
OPEN FURROW
TRUE LINE OF DRAFT

Fig 1.

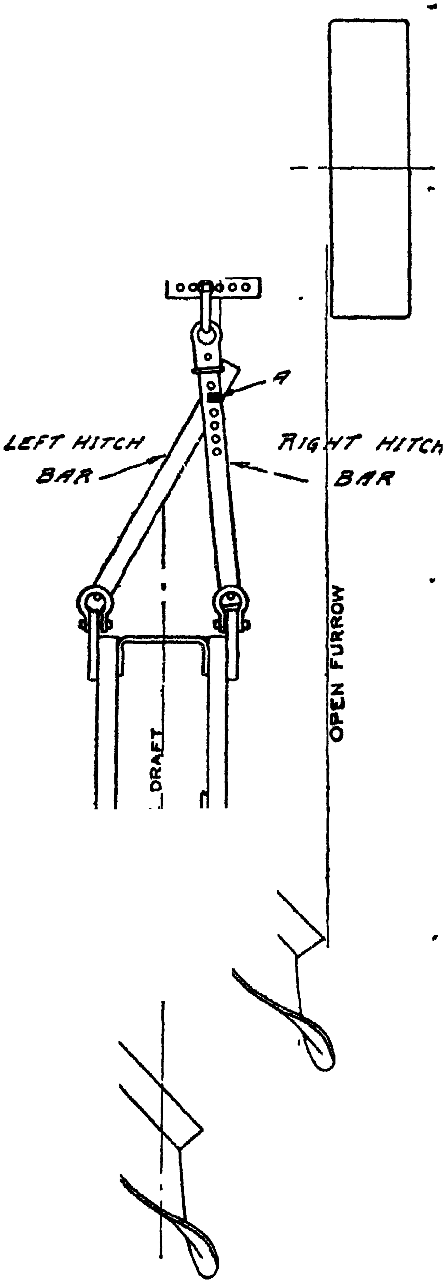
A
LEFT HITCH BAR
RIGHT HITCH BAR
DRAFT
OPEN FURROW

Fig. 2.

the length of one bar must be adjusted in respect to the other, — if it is only a matter of 2 or 3 in. too wide, either adjustment *a)* or *b)* can be used

If cutting too wide, (Fig. 2), the clevis may be moved on the drawbar to the right, or the right draw lengthened in respect to the left by moving the latter ahead on the former at *A*.

The principles of bar hitches described, are equally applicable to cross chain hitches still used in some sections on the larger tractor gangs.

For all practical purposes the centre of resistance of a 3-bottom plough may be taken to lie in the middle bottom at a point on the mould board about 2 in. from the shin and just above the share line. The hitch bars should be attached to the vertical clevises of the plough so that the bars lie as nearly as possible in the horizontal plane of the line of hitch (i. e. the imaginary line passing from the drawbar of the tractor to the above mentioned centre of resistance). Hitching higher will result in increased draft, and lower, in failure to penetrate properly.

Ordinarily in stubble ploughing, coulters should be set $^5/_8$ of an inch to land and from $1/2$ to $^2/_3$ the depth of the furrow. In sod ploughing, they should be set $1/2$ inch to land, set forward slightly from the stubble position and lowered to cut nearly the full depth of the furrow. The coulter is, as a rule, set on the beam so that its bearing is from 1 to 2 in. back of a vertical line from the tip of the share point (Fig. 3). These rules are however only general and cannot always be followed. Due attention should always be paid to the nature of the surface soil. If sharp shares and sharp coulters fail to penetrate properly and the trouble cannot be remedied by the coulter set, it is advised to raise the hitch bars on the vertical hitch plates, and as a last resort set the suck regulator so that the heels of the landsides are slightly raised. This adjustment will usually result in better penetration, but increased suck means increased draft and the operator should lose no time in going back to the original set recommended by the manufactures as soon as possible

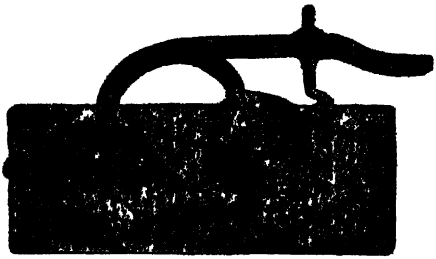

Fig 3 — Position of the coulter

Two fundamental principles should be understood with regard to failure to scour: firstly, the trouble is usually caused by the fine soil that breaks loose from the furrow slice, and, secondly, any adjustments that tend to increase the pressure of the slice upon the mouldboard will help to eliminate the trouble The following remedies are recommended.

1) Throw more of the sidedraft into the tractor;

2) set the coulters slightly wide or move the blades forward and set these wide

If these do not prove successful:—

3) Go back to the original set and then try raising the hitch bars a hole or two on the vertical clevises.

The so-called " winging down " (letting the front bottom cut a trifle deeper than the rear bottom) has often overcome the non-scouring difficulty, and its advantages outweigh its disadvantages.

An unsuspected cause of failure to scour in some instances is the speed at which the plough is run, and if a plough is employed which under normal conditions is too large for the tractor, all that can be done with the gang is to plough shallower unless one bottom can be detached. This should not however be confounded with the cause of slow speed due to excessive slippage owing to the soft friable condition of the surface of the fields. If there is no objection, however, to breaking into the subsoil to a greater depth, increasing the depth of ploughing may remedy entirely the non-scouring, because the pressure on the mouldboards will be increased.

By turning on the headland and leaving the plough at an increased depth until the point in the furrow is reached, where on the previous round the plough had reached its normal depth, and then bringing the plough back to its original position the depth may be maintained at the headlands at least for several trips. On a strip of unploughed land which is narrower than the plough, the whole outfit should be run so that the rear bottom is doing enough cutting to keep its point from hooking into and turning back the furrow slice on the left. The front plough will not do so much damage because it is the wing of its mould that hits the furrow slice on the right, and tends to keep that slice in its place. By dropping the plough a few inches on the land wheel to let it cut a small notch in the plough sole for the rear landside to work against and hold the plough in its correct position, the difficulties liable to arise may be overcome.

752 - **The " Mav " Cultivator for Rocky Land.** — MARRE, E (Directeur des Services agricoles de l'Aveyron), in *Le Progrès agricole et viticole*, Year 38, No. 19, pp. 455-458. Montpellier, May 8, 1921.

This new tillage instrument, designed especially for the rocky lands of the Causse, but which would be serviceable on all stony soils, even when not calcareous, has been thought out and constructed by M. BÉTEILLE, Matériel agricole et viticole (Mav), rue Pasteur, Béziers.

It has a rigid strong frame of special steel with rivetted joints. The working pieces, of cast steel with interchangeable parts of hard steel, can move out of the way on meeting abnormal resistance, such as that of a rock; they are kept in place or brought back into working position by powerful springs with a very small movement, which saves them from being bent or broken. The working pieces are fixed to the frame by means of bolted rings bearing the axis round which these pieces move

The penetration of the teeth into the soil is brought about by means of a crank axle governed through a screw by a flywheel, a chain, and a roller lifting the front at the same time. A seat, situated opposite the flywheel, enables a man to regulate the depth of digging while working.

The weight of the apparatus is about 500 kg. It can loosen a strip of ground 1.70 metres wide; in very favourable soil an average depth of 15 cm. can be reached, if necessary, by passing twice over the ground; but according as the difficulties, (hardness of the ground, the length of time it has been fallow, etc.), increase, it will obviously be necessary to pass more often over the ground to attain that depth. When that depth is reached, the soil is ready for sowing.

753 - **Penkala Press for Compressing Dry Pulp into Briquettes.** — BOUCHON, R., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VII, No. 15, pp. 374-379, Paris, April 20, 1921.

R. BOUCHON, sugar manufacturer, Nassandres (Eure), has pointed out the advantage of compressing dry pulp into briquettes in order to reduce the cost of packing, as the pulp is relatively bulky owing to its low density.

The problem of compressing dry pulps, substances which are at the same time both powdery and elastic and difficult to compress by vertical pressure, is solved by the press invented by the Polish engineer PENKALA.

Its principle is that of a continuous press which agglomerates the substance molecule by molecule, or rather bit by bit by a series of compressions, whence the very remarkable homogeneity shown by substances pressed in this machine

The first experimental presses were constructed by la Compagnie de Fives-Lille. For a press with a capacity of 10 tons in 24 hours, about 10 HP. was required. As it was desirable to produce a division in the substance pressed and obtain briquetes of a given weight, each of which would represent the ration of an animal, a cellular distributor was added to the presses as first constructed. With the mass compressed in this way the animals can be given their food rations in ordinary form. Immersed in water these briquettes swell rapidly and, after 2 hours, the pulp immersed in plenty of water resumes entirely the appearance of ordinary pulp. This press has also been tried with success for compressing fuel (1) and for making electrodes.

Examples of rations used at Nassandres.

	Working oxen	Fattening oxen	Milch cows	Sows
	kg.	kg.	kg.	kg.
Dry pulp	7 to 8	6 to 7	4 to 5	0.200
Rapeseed cake	1	—	—	—
Linseed cake	—	1 to 2.5	1	—
Oat meal	1	—	—	—
Barley meal	—	—	—	0.750
Bran	—	—	0.500	0.750
Chopped straw	4 to 5	3 to 4	4 to 5	—
Hay	—	—	4	—
Whey	—	—	—	4 to 5 litres

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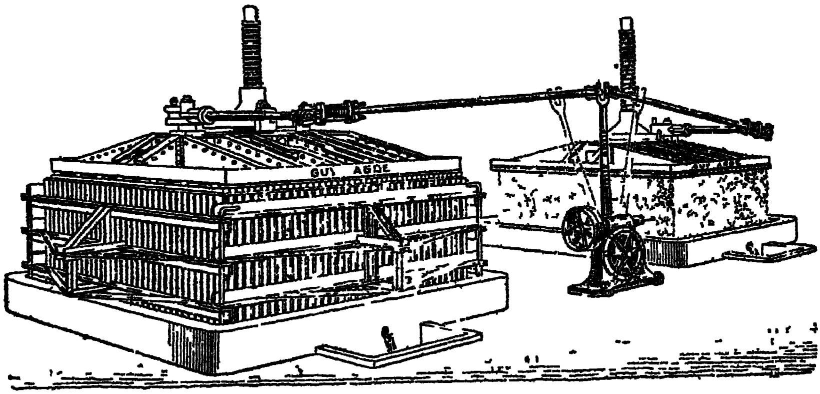
(1) See *R.* Feb. 1920, No. 247. (*Ed.*)

BOUCHON also gives some figures regarding the dry pulp from sugar factories, giving two analyses, as well as examples of the rations used on the Nassandres farms to which the sugar factory and refinery are attached.

The mixture is prepared 24 hours in advance and the pulp is steeped in plenty of water; the chopped straw is not added until the mixture is made and the pulp is thoroughly prepared.

754 - **The Guy " Motor-Press" for Applying Mechanical Pressure to Existing Installations.** — *Le Progrès agricole et viticole*, Year 38, No 18, pp 427-428, figs 1 Montpellier, May 1, 1921

The Guy Motor-Press has been made with the object of enabling wine-makers who make a medium, or even a small amount of wine, to benefit by the advantages of mechanical pressing, at the lowest possible cost of installation and making use of existing apparatus.



The Guy Motor-Press, on a base (without motor), working 2 presses

The Motor-Press is made in two patterns :—

1) Pedestal pattern, the more usual pattern, suitable when the presses are away from a wall and arranged about the middle of the cellar.

2) Wall pattern, used when the presses are arranged along a wall of the cellar.

DESCRIPTION. — The automatic system of constricting or pressing is essentially composed of an apparatus of the pedestal or wall pattern separate from the existing pressing apparatus and forming the Motor-Press properly so-called. The apparatus consists essentially of a cast-iron case, enclosing, protected from dust and accident, and in an oil bath, a *speed reducer of* 1/60 and a *transformer of circular movement into alternating movement.*

With the apparatus all the small high-speed motors (electric especially), can be connected directly, by a simple band, with an axle bearing pullies (turning at 300 revolutions a minute); an attachment can also be made of its large, very slow moving (4 to 5 revolutions a minute) arm, and by means of dynamometric connecting rods and cardan joints, to special bars fitting into the sockets of the existing presses.

A single "Motor-Press" (of the pattern made by GUY of Agde) can work 1, 2, 3 or 4 presses of any kind, arranged in any manner, together or separated and can do so with only 1/4 to 1/3 HP. per press according to the forms of the construction of the presses.

WORKING. — The press or presses being loaded in the ordinary way, and the charges and apparatus being brought to the required position by a small hand bar worked by one man, the man attaches the dynamometric connecting rod or rods which are hooked up in their position of disengagement, and then starts the Motor-Press.

The constriction or pressing takes place gradually, and, when the maximum pressure of the resistance of the press or presses is reached, that is to say the equivalent of the force of 4 men, a safety spring, by becoming compressed, shortens the stroke and owing to this the catches of the ratchet mechanism no longer fall into the recesses, the screw plate remains stationary and no longer presses, the Motor-Press still continuing to work, so to say, empty. This continues until the fresh or fermented grape husks becoming drained, the internal pressure decreasing and becoming less than that of the dynamometric safety spring, the latter relaxes, the normal length of stroke is re-established and the catches of the ratchet again fall automatically until a further period of maximum pressure occurs.

Automatic pressing is thus attained, and without attention, the Motor-Press can be allowed to go on working without stopping during meal times, and thus valuable time is saved compared with the time taken by ordinary pressing.

In case of possible breakdown of the motor, pressing can be continued by hand in the ordinary manner.

When pressing is finished all that has to be done is to turn back the catches and the Motor-Press commences to remove the pressure from the press or presses and the loads and apparatus are lifted in the ordinary way by hand, if the apparatus is not heavy, or by means of a special mechanism invented by the same constructor.

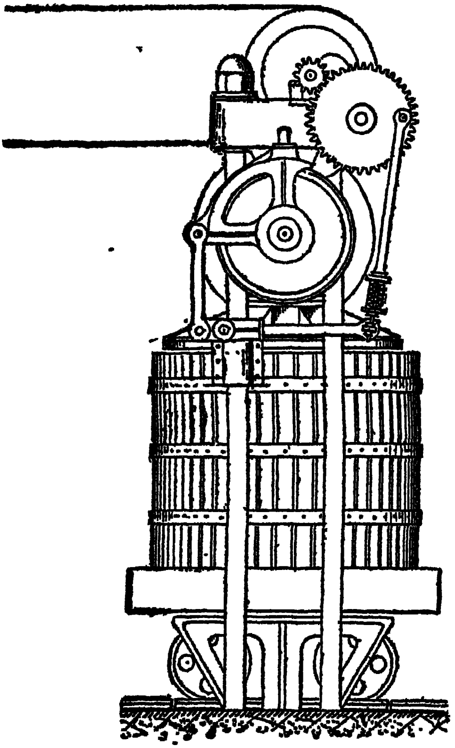
755 - **The Simplex Super-press with Movable Pan and High Pressure.** — VENTRE, J. (Professeur d'Œnologie à l'École nationale d'Agriculture de Montpellier), in *Le Progrès agricole et viticole*, Year 38, p. 327-334. Montpellier. April 3, 1921.

This apparatus, built to the design of P. PAUL, seems to fulfill the double object of producing great force and automatically exerting progressive pressure.

Like the hydraulic press, the new apparatus has a movable pan and the diameter of its sieves is about 1 m.; the pressing plate is supported and pressed down by two knee joints, the heads of which approach and recede from each other. These are controlled by a double threaded screw automatically pressed on a plate with catches.

As the angle between the knee joints decreases the pressure increases in the proportion of 1 to 10.

This mechanism has a total force of 100 tons, that is to say a pressure of 10 to 12 kg. per square centimetre. The pressing takes 35 minutes. It is regulated automatically, for, if the descent of the pressing plate is more rapid than the escape of the liquid requires, the catch ceases to fall so that pressure is not removed until the juice previously expressed is cleared.



Side view of the Simplex Super-press.

The raising of the pressing plate takes only 9 or 10 minutes so that one sieve can be entirely pressed and replaced by another in three quarters of an hour, or, allowing for clumsy working, in an hour

Only from 1 to 1.5 HP. is required, and can be supplied by a small electric or petrol motor.

The pressure is direct and this does away with the necessity for a regulator, the maintenance of which is always delicate. Stopping, both in raising and descending, (when the thickness of the cake is too little), is automatic so that no attention is required. Pressing by means of this apparatus is carried our under good conditions, for it is done by using the two most favourable principles for the clearance of the juice, namely:—

1) The pressure only increases gradually and slowly proportionately to the compression of the grape marc, so that felting of the sieves is prevented.

2) The pressure instead of being continuous, is obtained by a series of successive shocks leaving sufficient time between them to allow of the circulation and clearance of the wine enclosed in the marc.

The effect formerly obtained with percussion presses, which had the reputation of producing a much better draining of the grape marc than was obtainable with other kinds of presses, is therefore realised with less manual labour but with greater pressure.

756 – The Alexis Chaussepied Apparatus for the Rapid Production of Sparkling Wines.

Revue générale du Froid et des Industries frigorifiques, Year I, Vol. 1, No 12, pp. 399-401, figs 1. Paris, Dec 1920.

The process covered by the Alexis CHAUSSEPIED (of Saumur) patent makes it possible, using cold, to obtain, in the shortest possible time, sparkling wines of identical composition and quality to those obtained by fermentation in bottles according to the Champagne method.

The wine is composed precisely as if it was to be drawn to ferment in bottles, but the various operations; — Fermentation, dosing with the transport liquor, clarification, are not done in bottles, but in wooden vats containing from 10 to 40 hectolitres, which are enclosed in steel tanks sufficiently strong to hold the carbon dioxide produced by fermentation and whose pressure, under which it is dissolved in the wine, is capable of being regulated as desired by a valve.

After clarification, which is accelerated and made perfect by the action of cold, the deposit, resulting from the second fermentation in the closed vat, is got rid of; the clear sparkling wine is then bottled by means of isobarometric apparatus of the same kind as that used for bottling low gravity beers; the low temperature at which the bottling is done prevents effervescence and loss of carbonic acid gas

APPARATUS. — The apparatus is composed of a wooden vat 1, open at the top; the bottom 3 of this vat is pierced by a hole 4 in which is fixed by watertight washers, a metal piece 6 through which passes the tube 7, made of glass (or silver plated metal). This piece is covered, inside the vat, with a wooden cap 8 pierced with a hole through which passes the tube 7, intended to prevent contact between the wine and the metal piece 6.

The vat 1 is enclosed in a metal recipient capable of resisting the pressure of the gas produced by fermentation; the bottom 10 of this recipient is pierced by the piece 6 on which is screwed a nut 11 to form a watertight joint by means of washers. Tow packing is placed round the tube 7 and is pressed tight by the nut 12. On the nut 11 is screwed a piece 14 forming a solid piece with the tube 7 and which enables this tube to be raised or lowered. The piece 14 ends in a three-way tap 19.

The recipient 9, furnished with a thermometer 25 and spy-holes 26, has in its upper part an air-chamber 27 fixed with screws and a water-tight joint. The chamber 27 bears a metal tube 30 prolonged, at 31, by a glass tube 32, which is larger in diameter than the tube 7 which it protects against the fall of deposits.

The tube 30 opens out above into the feed bottle 33 with a tap 34 between them; it also communicates by a tube 35 with a pump 36, which draws out by the tube 37 the gas contained in the chamber 27 and drives it back by the tubes 35, 30 and 32.

The chamber 27 also has a tube 38 with a tap 39 communicating with the upper part of the feed bottle 33 and a tubing 40 carrying a manometer 41, a valve for regulating the pressure 42, and a tap 43, allowing communication by the pipes 51 with the arrangement for drawing off the wine into bottles and with a compressed air or gas container 57.

Inside the receptacle 9, and above the vat 1, is a coiled pipe 44, which communicates with a recipient 45 and through which can be made to circulate, as desired, heating or cooling liquids.

WORKING. — The wine is prepared in a big tun or in casks with all the necessary ingredients as in the Champagne method except that no tannin is added; the wine at this moment is a real culture broth of alcoholic yeast, fermentation having commenced regular action, the wine is introduced into the vat 1 through the feed bottle 33.

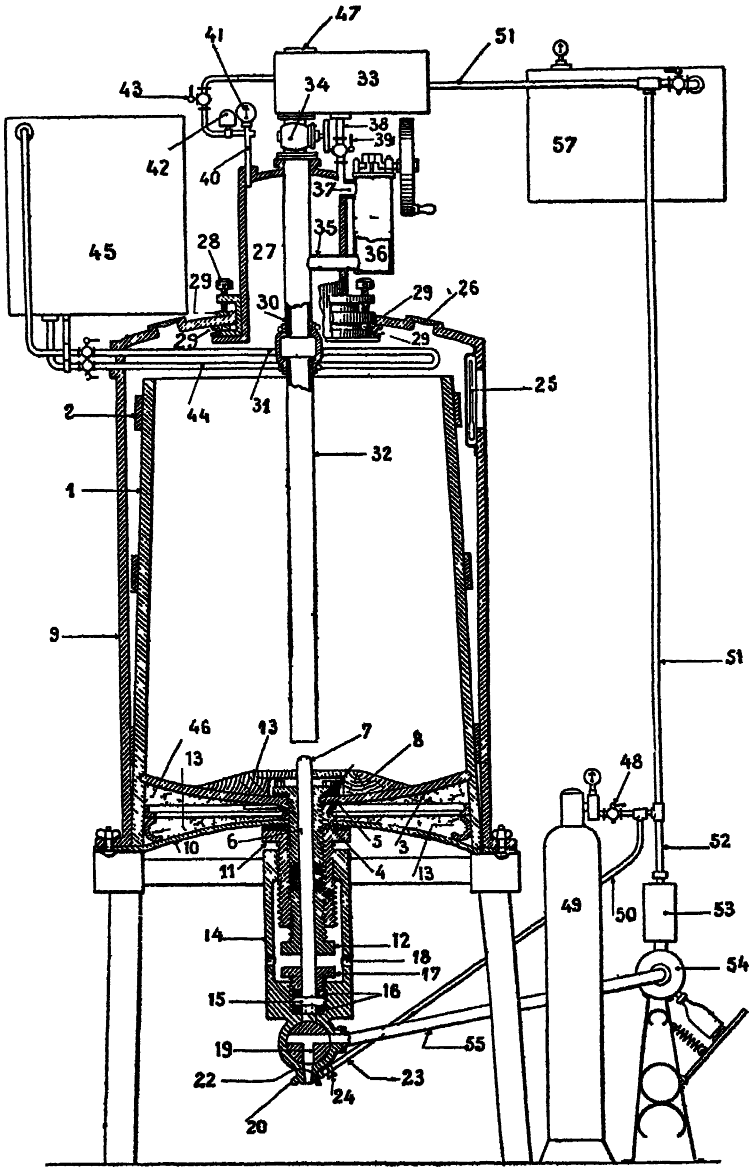
With this object, after closing the tap 19 and raising the tube 7 above the bottom of the vat by moving the piece 14, the stopper 47 is taken out and the taps 34 and 39 are opened; the wine runs through the tubes 30 and 32, the taps 34 and 39 are then closed and the stopper 47 is replaced.

Fermentation continues in the vat and it is quickened by starting the pumps 36; the gases drawn through the opening 37 are driven back through the tubes 35 and 32 causing continuous movement and mixing of all the ingredients in the wine.

When fermentation is finished (or, if it is desired to stop it, before it is complete) cooling liquid is made to circulate in the bent tube 44, and the pump is set in motion; the gases cooled by contact with the bent tube, are driven back into the vat, where they cause cessation of fermentation and the dosing is proceeded with.

The transport liquor — which contains the necessary dose of tannin (required to ensure the precipitation of all the albuminoids) and of glue — is introduced into the feed bottle, and, after the stopper 47 has been replaced it is run into the vat by opening the taps 34 and 39 which are then closed. This liquor is mixed with the wine by the pump which continues to work as well as by the circulation of the cooling liquid in the coiled tube to bring the wine as near as possible to its freezing point: at that moment the pump is stopped.

The wine, which is now effervescing and dosed, being at rest, clarification takes place by the action of the tannin on the albuminoids and by that of refrigeration; it is further facilitated by the presence of carbonic acid gas under pressure, which renders it absolutely perfect in a very short time the deposit is then collected, settled, at the bottom of the vat in a compact, solid mass above which the sparkling wine clear and liquid is led off by the tube 7 The low temperature is maintained by the circulation



The CHAUSSEPIED apparatus for the rapid production of sparkling wines

[756]

of the cooling liquid during the whole duration of clarification and bottling; owing to it, the latter operation is effected very easily without effervescence and without any loss of carbon dioxide.

The bottling is done by means of counter-pressure extractors like those used for bottling low-gravity beers; the pressure is ensured by compressed air or by carbon dioxide — coming from the vats under fermentation — contained in a tube 49, or in the container 57. The bottles are then corked and wired in the usual way and they are then ready for dispatch.

Each apparatus is enveloped in an isolating cover which shelters the contents from variations in the outside temperature and barometrical pressure as well as from draughts which have such a bad effect on the progress of fermentation. Owing to this isolation, which is as perfect as possible, each apparatus works independently of the others, which may be at different stages of the making, without affecting those which come near them, and it is thus possible to collect a fairly large number of apparatus in the same premises, the mean temperature of which is not of great importance provided it is not exaggerated one way or the other; it may vary between +10° and +30°C.

Each apparatus produces, in 1 month at most, its content of sparkling wine ready for dispatch.

The refrigerators required are of small power (600 to 3000 frigories an hour) and are only used during 3 or 4 days for each apparatus so that they can each work a fairly large number of machines.

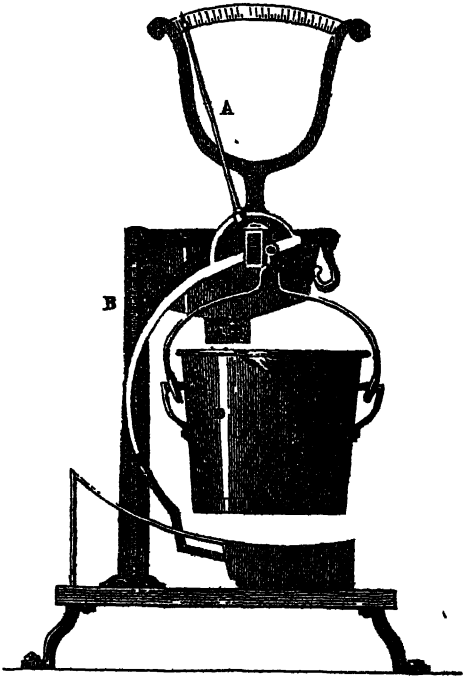
This process has proved its value in practice. Apparatus of 1000, 2000, and 4000 litres are working at present some of which have produced, under the conditions described alove, several charges of wine which have given complete satisfaction.

757 – **Milk-weighing Balance.** — GOUDOT, G., in the *Journal d'Agriculture pratique*, Year 85, Vol. 1, No. 19, pp. 379-380, figs. 2. Paris, May 14, 1921.

The author describes a good type of milk-weighing balance (illustrated in the figure below) used by cheese makers in Franche-Comté.

This balance is a steel yard the of which shorter arm supports the pail which holds the milk; the longer arm, bent in a circular arc, ends below in a weight calculated so that when the pail is empty the point of the hand *A*, fixed on the upper part of the arm, points to zero on the dial at the top of the apparatus. On this dial, starting from zero on the left, are marked large divisions each of which corresponds to 1 kg.; each of these divisions is divided into four parts corresponding to ¼ kg., respectively. Each kg. is reckoned as being equivalent to 1 litre of milk which in practice causes no objection. For weighing, the milk is poured into wire-mesh strainer designed to strain out impurities suspended in the milk. This strainer is fixed to the support *B* by means of an iron pin and is moveable round this support so that its lower aperture is over the pail while the milk is being strained and so that it can be moved to one side to lift the pail when filled.

The working of this weighing machine is therefore very simple. But in order for the balance to weigh accurately it must be quite vertical and the feet that support it should be firmly bolted to the floor of the room where the milk is received; otherwise the slightest disturbance may interfere with the accuracy of weighing. It is further necessary, for accurate weighing, that the axis of the beam should be kept dry, as rust would cause irregular weighing.

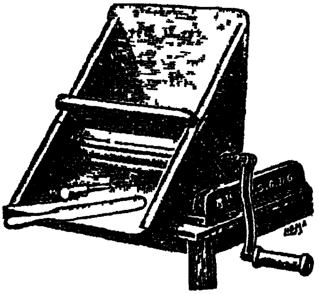


Front view of the milk-weighing balance.

758 - **Reciprocating Butter-worker.** — MAURIN, G., in the *Journal d'Agriculture pratique* Year 85, Vol. 1, No. 20, pp. 397-398, figs. 2. Paris, May 21, 1921.

With this new butter-worker, called " alternating, " it is possible to work up very small quantities of butter for which hitherto a spatula and a dish were used to get rid of the buttermilk and to work up the butter. This butter-worker, illustrated in the figure here reproduced, consists of a prismatic hopper with a triangular base, divided into two compartments by a partition below which rotates, in a horizontal plane, a grooved wooden cylinder worked by a crank handle outside. This handle can be placed either in the right or left of the hopper, the latter being able to rock backwards and forwards on two pivots below held in a frame which is attached to a table.

The butter is placed in the hopper which for the moment is uppermost, on rotating the grooved cylinder it draws and flattens the butter and removes the buttermilk in forcing the butter into the lower hopper, which slopes slightly so that the buttermilk and the water used for washing will drain away. Then the hopper is turned over on its lower pivots and the grooved cylinder is rotated in the opposite direction. The operation is repeated as often as is necessary, the butter being sprinkled with clean water After passing a few times the butter is thoroughly washed, worked up and separated from the buttermilk; it can be salted at the same time.



DAVID reciprocating butter-worker.

This butter-worker is made by the Firm L. DAVID, 56 Route d'Evreux, Vernon (Eure), France

RURAL ECONOMICS

759 - **Cost of Milk Production** (1) **in some States of the North American Union.** — *The Creamery and Milk Plant Monthly*, Vol X, No. 1, p 43 Chicago, Ill., January 1921.

The best way of estimating the cost of milk production is to determine it carefully in each administrative unit. The Dairy Division of the Department of Agriculture of the United States has instituted an enquiry for this purpose addressed to the groups of farms in 7 States of the Union. Data referring to 4 groups are now to hand. Each group consists of 20 dairies that are typical for their administrative unit.

The aim has been as far as possible to estimate the cost of production by quantity, rather than by price, in order to be able always to interpret the data by supplying the current price.

A summary of the data is given in the Table on p. 909.

AGRICULTURAL INDUSTRIES

760 - **Exhibition of Hybrid Wines at Mâcon, Saône-et-Loire, France** (2).— LAPRUGNE, in *Le Progrès agricole et viticole*, Year 38, No. 12, pp. 279-280. Montpellier, March 20, 1921.

The annual exhibiton of wines produced by hybrid bearers organised by the Agricultural Society of the arrondissement of Mâcon, was held on February 20, 1921. Over 50 samples of wine were shown, coming from Saône-et-Loire, the Côte d'Or, Haute-Marne, the Rhône, the Drôme, the Landes.

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(1) See *R.*, May 1921, No 554. (*Ed.*)

(2) See *R.* April 1921, No. 458. (*Ed.*)

Units necessary for the production, of 100 *lbs. of milk.*

		Indiana (1)		Vermont		North Carolina (2)		Washington	
Average annual milk production per cow (pounds)		6 937		5 252		4 915		7 833	
Percentage of butterfat		3.8		3.9		—		3.7	
		Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Grain	lb.	38.5	20.0	33.1	8.7	57.8	48.4	29.4	5.2
Hay and other dry roughage	lb.	66.8	27.4	129.9	18.7	78.5	36.9	92.9	7.5
Ensilage and other succulent ronghage.	lb.	147.6	60.1	191.3	27.8	181.5	87.0	143.3	40.4
Hauling and grinding of concentrates		$ 0.03	$ 0.014	$ 0.020	$ 0.005	—	—	$ 0.022	$ 0.003
Litter	lb.	20.3	—	11.2	—	(a) $ 0.008	—	9.0	0.1
Pasture	acres	—	0.040	—	10	(a) $ 0.012	(a) $0 .205	—	0.025
Human Labour	hours	2.5	2.2	2.7	2.0	3.6	3.2	1.9	1.3
Horse-Labour (2)	hours	0.3	0.2	.6	0.4	1.8	1.8	.01	0.015
Over-head and other expenses (3)		$ 0.385	$ 0.393	$ 0.555	$ 0.425	$ 0.537	$ 0.495	$ 0.576	$ 0.406
Calf credited units (4).		0.012	0.013	.025	0.009	(a) $ 0.548 (calf and manure)	(a) $ 0.430	0.017	0.009

(*a*) The data for these items were obtained in money value.
(1) *U. S. Department of Agriculture, Bulletin* 858.
(2) *North Carolina Department of Agriculture, Bulletin* 266.
(3) Most dairy-farmers sell their milk retail, and this labour was for transport.
(4) By unit, 1 calf is understood.

In general, the opinion of the judges is that, under present conditions, when wine is made in too small quantities, the qualities of most of the samples cannot be judged and that a final evaluation would only be possible with wines made in a normal way in vats or casks. Nevertheless they summed up their valuations in the following notes:

1) *White wines.*

Bertille-Seyve 450. — Good wine, right flavour.
Seibel 880. — Vintage of 1919, good wine, pleasant, flinty taste.
Seibel 867. — Fairly pleasant, though very slightly foxy.
Seibel 4657. — Foxy wine.
Seibel 5061. — Insipid common wine.
Seibel 5213. — Shown as old, has a peculiar rancid flavour.
Seibel 5279. — Fairly good, alcoholic, slight peculiar flavour, rather pleasant.
Seibel 5409. — Peculiar unpleasant flavour.
Seibel 58-60. — Insipid wine, little alcohol, unpleasant aftertaste.
Seibel 1000. — Made as white wine, slightly rosy, interesting but badly shown.
Malègue 747-8. — Muddy wine, decidedly bad.
Le Brillant. — A wine which does not deserve the name of the vines which produced it.

Commerçon 2157. — Pronounced flavour of honey.

Baco-Thomur. — Wine with body and fineness; fairly mellow.

Baco Maurice Baco. — Peculiar flavour resembling the wines of Folle blanche, but much more pleasant.

Baco Dourion. — Fairly pleasant wine.

The wines made from mixed vines were not valued, not because they were despised, for possibly their mixing is a good operation, but, because the judges restricted themselves to observations on the characters of the hybrids, in order to bring out their respective merits later on.

2) *Red wines.*

Madone. — Vintage of 1919, full flavoured wine, deep coloured.

Couderc 4401, Buffet selection. — Insipid wine, common, but neutral, fine colour.

Couderc 162-97 (Drôme). — Indifferent wine, apparently badly made.

Couderc 7120 (Drôme). — Peculiar flavour, fine colour.

Baco No. 1 (Sologny, S.-et-L.). — Good wine, with body and colour.

Baco No. 1 (Haute-Marne). — Nice looking wine, which cannot be valued as it tastes of the cask.

Baco No. 1 (Montaguy-les-Buxy, S.-et-L.). — Made as a pink wine, "tender" wine, pleasant flavour, alcoholic.

Baco No. 1 (Landes). — Good wine, full bodied, deep coloured.

Baco-Estellat. — Wine with very good flavour, pungent, has fineness and bouquet, bright red colour.

Bertille-Seyve 872 (S.-et-L.). — Good ordinary wine, slightly earthy flavour.

Bertille-Seyve 872 (Drôme). — Foxy.

Bertille-Seyve 893 (S.-et-L.). — Ordinary wine, slightly acid.

Bertille-Seyve 893 (Drôme). — Passable, slightly peculiar flavour.

Bertille-Seyve 893 (Rhône) — Thin, with an earthy flavour.

Oberlin 595 (S.-et-L.). — Neutral wine, very deep coloured.

Siebel 1000 (S.-et-L.). — Vintage of 1919, very good wine in every respect.

Siebel 1000 (Drôme). — Vintage of 1919, neutral wine, thin, seems not to have been well made.

Siebel 4643 (Drôme). — Slight peculiar flavour; appears, like the last mentioned to have been badly made.

Siebel 4643 (Rhône). — Fairly pleasant wine, very slight special flavour, a little tart.

Siebel 4643 (S.-et-L.). — Fine wine, coloured.

Siebel 4643 (Hte-Marne). — Vintage of 1919, insipid and thin, special flavour, seems to have been badly cared for.

Siebel 4716 (Drôme). — Has fineness, colour rather yellow, alcoholic, flavour of old wine.

Siebel 5181 (Drôme). — Good wine, deep colour, slight special flavour.

Siebel 5181 (Rhône). — Made as a pink wine, light colour, interesting to see how it will mature.

On the whole, the red wines appeared more interesting and more successful than the white wines. The inequalities noted for identical hybrids are doubtless due partly to differences of soil and climate, but they appear to be due chiefly to the care taken in the gathering of the grapes and in the making.

761 - **Making Wine from Must of High Sugar Content.** — Mensio, C., in the *Giornale Vinicolo italiano*, Vol. 47, No. 12, pp. 112-114; No. 13, pp. 122-123. Casale-Monferrato, March 20 and 27, 1921.

The author describes an experiment which he made on a white wine of Castellammare del Golfo (Province of Trapani), with a high percentage of alcohol and also containing much unaltered sugar. The object was to ascertain the cause of its slow and difficult fermentation.

By fermenting musts very rich in sugar the author was able to get up to 19.5 % volume of alcohol, in laboratory tests, but he could never get more than 18 % under ordinary wine-making conditions. In the case investigated the wine contained 16 % of alcohol and 6.4 % of unaltered sugar; it therefore was made from a must containing 34 % of sugar, which, after complete fermentation, should have given a wine containing 19.7 % of alcohol.

The determination of the chemical composition of this wine and of the conditions under which fermentation took place led to the conclusion that the cause of the slowness and difficulty of fermentation was the excessive concentration of the must. The very small quantities of acetic acid and lactic acid found, proves that the fermentation of the wine in question did not reach too high a temperature. The author considers that it is practically impossible to get complete fermentation in such concentrated musts; nor does he consider it profitable, since such must could be used to greater advantage in making sweet filtrates, concentrated musts, or luscious, alcoholic, and sweet wines. The author thinks it would be more expedient to try to get a fairly rapid fementation, to produce 16 % of alcohol. without continuing it to the complete decomposition of the sugar. In a wine containing 16 % of alcohol a residue of sugar, even if fairly considerable, can do no harm. The best way of procuring this rapid fermentation is to inoculate a prepared yeast made with another less concentrated must (containing from 15 to 20 % of sugar) that has been fermenting from 24 to 48 hours. The quantity of that yeast should be from 2 to 3 % if the temperature is less than 20°C, and 1 % if the temperature is over 20°C. The fermentation will be governed by the same rules as those which regulate wine-making in hot climates (stirring the must so that the ferments spread throughout the mass; aeration repeated twice or more; moderate sulphuration; decantation according to the pace of fermentation).

Dilution of concentrated musts with water has been recommended, but in view of the present high cost of transport and casks and, on the other hand, the increasing demand for luscious sweet wines, the author doubts that such a method could be really better.

762 - The Alexis Chaussepied Apparatus for the Rapid Production of Sparkling Wines. See No. 756 of this *Review*.

763 - Balance of Nitrogen and Chlorine of Beetroot during the Manufacture of Sugar. — I. SAILLARD, E., Balance of Nitrogen during the manufacture of sugar. Precipitation of the albuminoids of beetroot by sulphuric acid, bisulphites and hydro-sulphites, in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 2, pp. 129-130. Paris, Jan. 12, 1920. — II. ID. The balance of chlorine during the manufacture of sugar and the chlorine content of beetroot. *Ibid.*, Vol. CLXXII, No. 5, pp. 283-284. Jan. 31. 1921,

I. — In a previous paper (1) the author has indicated what became of some of the elements from beetroot during the manufacture of sugar. In that paper the balance of dry material was shown as follows: —

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(1) See *R.* 1918, No. 815. (*Ed.*)

		kg
Dry material from 100 kg. of beetroot		22.3
» » contained in pulp and diffusion water	5.6	
» » contained in the carbonatation cakes	1.2	
» » contained in the molasses	3.0	
» » contained in the white sugar	12.4	
Loss and sundries	0.1	
		22.3

Now the author notes that, from 100 kg. of beetroot about 50 kg. of dressed pulp, used as forage, and 40-50 kg. of press water are obtained. Its average composition may be represented as follows: —

	Per 100 of pressed pulp	Per litre of strained press water
Dry matter	8.5 – 10	8.5 gm.
Sugar	0.60	4.5
Ash	0.55	1.2
Total nitrogen	0.10–0.13	0.10–0.12

This means that the dry matter carried away in the press water is about 8-10 % of what remains in the pressed pulp ; the nitrogen is divided in approximately equal proportion between the pulp and the liquid. These figures, in conjunction with those of the first paper, show that in sugar factories which distil their molasses and incinerate the vinasses, the nitrogen from the beetroot is distributed on the average, per 100 of total nitrogen, in the following manner: —

In the carbonatation cakes	15
In the forage pulp	20
In the press and other waters	18
Given off in the form of ammonia during the process	17
Given off during the incineration of the vinasses	30

II. — When establishing the balance of chlorine, allowance was made for the chlorine contained in the well water which was used in the diffusion battery (0.02 gm. per litre). The following figures are average figures from ten sugar factories: —

Chlorine in the beetroot	0.016 %
Chlorine in the molasses	0.30
Chlorine in the beetroot contained in the residues of diffusion	19.00
Chlorine of the beetroot contained in the molasses	80.00
Undetermined losses	1.00

The distribution of the chlorine taken up in the soil by the roots among the various parts of the plant was, according to the following analysis made with beets containing 17 % of sugar: —

	Average weight of a plant	Moisture	Chlorine per 100 of dry matter
Blades of the leaves	127 gm	84.3 %	1.00 %
Petioles and principal rib of the leaves. .	296	85.9	1.80
Root collars	49	79.2	0.34
Topped roots	530	75.3	0.08

These figures show that the petioles have highest chlorine content; this remark applies also to mangolds. In the whole plant there is 1.2 of chlorine per 100 of sugar of the topped root, an amount which varies according to the conditions of growth.

764 - **Raw Materials for Industrial Alcoholic Production; Sugar Beet, Prickly Pear, Molasses, Potatoes, Sweet Potatoes, Maize, Acorns, Straw and Sawdust.** — I. JURITZ, A. C. Raw Materials for Industrial Alcohol Production, in *The South African Journal of Industries*, Vol. IV, No. 2, pp. 167-175. Pretoria, Feb. 1921. — II. BOAS, I. H., The Manufacture of Alcohol from Waste Wood or Sawdust, in *The Indian Forester*, Vol. XLVIII, No. 3, pp. 135-137. Allahabad, March 1921.

II. The raw materials possessing possibilities of being employed as bases for the production of industrial alcohol may be placed in 3 groups, namely, 1) sugar, 2) starch: 3) cellulose.

1) *SUGAR GROUP.* — a) *Sugar Beet.* — The juice derived by expression from sugar beet contains on an average about 15 % of sucrose. The yield may vary from 10 to 20 tons per acre; Germany showing the highest average in Europe. The yield of alcohol per ton of roots ranges from 11 to 24 gallons. If therefore, the average yield of beet be 12.5 tons per acre and the proportion of sugar therein 14 %, the consequent yield of 1.75 ton of sugar per acre will correspond to a theoretical yield of 237 gallons of absolute alcohol.

b) *Prickly-Pear Fruit.* — This is said to contain on an average about 10 % of sugar directly and completely fermentable into alcohol, and according to investigations carried on in the New Mexico College of Agriculture, a yield of 10 tons of fruit per acre was estimated, and it is estimated that 10 tons carrying 10 % of sugar, would yield 128 gallons of alcohol, and would bring in £ 6,5 s. per acre which is considered to be a good return for otherwise worthless land, entailing little or no cultivation.

c) *Molasses* (1). — This forms undoubtedly one of the cheapest raw materials for alcohol. At its highest value, the cost per gallon of alcohol thus obtained is 8d. It has however been estimated that the total raw material available for example in the United States and Cuba would produce only 162 million gallons of alcohol, or 5 % of the total requirements for motor fuel. The author gives details of the output of Natal in particular, and also quotes extracts from the paper read by HERIOT before the Scottish Section of the Society of Chemical Industry 1915 (1), showing the quantity and cost of production of alcohol from molasses in various countries.

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(1) See "Molasses as a Source of Alcohol for the Production of Power", by T. H. P. HERIOT, in *Journ Soc. Chem. Ind.*, Vol. XXXIV, pp. 336-340.

II. *STARCH GROUP.* — a) *Potatoes.* — In a German potato distillery 100 kg. of potatoes are reckoned to furnish 20 kg. of starch, yielding 11.5 to 12 litres of 100 % alcohol. In Germany a particular variety of potato is grown exclusively for alcohol production, giving a specially large yield of tubers per acre, and containing a very high percentage of starch. Out of a total production of 4 ½ million hl. of alcohol (reckoned at 100 %), 3 ½ million hl. came from potatoes in 1918-19. The approximate yields per acre and corresponding potentialities for starch production for the various countries are tabulated.

b) *Sweet Potatoes.* — This contains approximately 25 % of starch and sugar. Assuming the yield to be no more than 4 tons per acre, the theoretical yield of the aforementioned elements would be about 2000 lb. per acre. Therefore from 1 acre of sweet potatoes, approximately 140 gallons of absolute alcohol should be obtained.

c) *Maize.* — The theoretical production per ton of maize may be estimated as 1360 lb. of starch (equivalent to 97 gallons of absolute alcohol), which compares well with the above crops. The amount of alcohol produced in actual practice bears the high proportion of 87 % to the theoretical yield, compared with the 77 % for potatoes. New Zealand apparently heads the list as regards the yield per acre of grain.

d) *Acorns.* — The author states that peeled acorns are said to contain about 40 % of starch together with some cane-sugar. At present, except for pig feeding, they are not much used, but once the difficulties are overcome there seems no reason why these should not be employed to advantage with regard to motor fuel.

3. *CELLULOSE GROUP.* — a) *Prickly Pear Stems.* — These of sections do not contain starch, but cellulose, and unless hydrolised by means of dilute acid, would possess no value for alcohol production.

b) *Straw.* — The same remarks apply to treatment of straw.

I-II (c) *Sawdust.* — The average yield of alcohol per ton of dry sawdust is about 20 gallons, but it should be remembered that the cost is nil, while that of other materials considered is considerable. Much research is needed to find methods of improving the yield, and it is also desirable to make a complete investigation of the sugars so formed. Methods may then be established to promote fermentation (1). In view of the importance in many countries of replacing petrol by another form of liquid fuel, this problem is extremely important.

The great obstacle in the way of the production of a larger proportion of alcohol from sawdust is the impracticability of completely converting the cellulose into sugar unless the material contains no more moisture than just enough to render it damp, and the hydrochloric acid used for hydrolysis is of at least 40 % strength. According to English Patent

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(1) Research is now in progress at Berkeley University, San Francisco, with the constituents of the wood. (*Author's note*)

107,219, of May 23, 1916, by R. A. KOCHER of San Francisco, founded apparently on the researches of WILLSTÄTTER and ZECHMEISTER (1) maintenance of these conditions effects almost quantitative saccharification within 24 to 48 hours. Such a method would be a distinct advance on the processes hitherto in operation, as it effects the change at the ordinary temperature, in spite of the fact that the claim has been disputed (*Journal Chem. Soc.*, Vol. CXIII (1918), p. 181), where it is stated that it rested solely on polarimetric observations and the equally non-specific data of cupric reduction and was therefore inadmissible.

765 - **Contribution to the Knowledge of the Biochemical and Biological Qualities of Goats Milk.** — CORDES, F., in the *Zeitschrift fur Ziegenzucht*, Year XXII, No. 1, pp. 1-3. Hanover, 1921.

The author registered the milk production of goats (2) during one period of lactation, and determined the percentage of fat in the milk; in addition he determined the acidity, the catalase and diastase, and he made the alcohol test.

The milk production, which was 800 kg. per period of lactation before the war, has now decreased to between 500 and 400 kg., a quantity which is still equivalent to from 10 to 13.5 times the live weight. The fat content was variable. The average figures of the percentage of fat in the milk of the different goats varied between 2.72 and 4.11 %. The morning milk was, on the average, poorer in fats than the evening milk and the latter poorer than the mid-day milk.

The fat content of the morning milk is recorded as 3.29 %, that of the mid-day milk as 4.19 % and that of the evening milk as 3.94 %.

The alcohol test for ascertaining the freshness was of no use as the milk co-agulated every time.

The degree of acidity was determined by the SOHXLET-HENKEL method. The values obtained showed great variations; the average figure was 4.7 degree of acidity. The determination of the catalase gave results showing considerable differences. Thus treating 15 cc. of morning milk with 5 cc. of $H_2 O_2$ gave a lowest value of 0-5 catalase and a highest value of 7; the average was 2.25. The figure of catalase increased with the age of the goats.

The estimation of the diastase in goats' milk was made with KONINGS' method; here also a marked difference was recorded between the morning and evening milk; the smaller milkings showed the higher figure of diastase; 10-30 mgm. of starch were decomposed in 30 minutes by 100 cc. of fresh raw milk (3). No influence of the period of lactation on the diastase content was noticed.

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(1) *Berichte der Deutschen Chemischen Gesellschaft*, Vol XLVI (1913), p. 2401. (*Ed*)

(2) Flock belonging of the Brunswick Breeding Society, composed chiefly of goats of the Saanen breed. (*Ed.*)

(3) See KÖNIG, *Chemie der menschlichen Nahrungs-und Genussmittel*, Vol III, Part II, p. 238. Berlin, 1914. (*Author*)

766 - **Freezing Broken Eggs** (1). — I. MONVOISIN A. (Chef des travaux de physique et de chimie à l'École d'Alfort; chargé de l'enseignement de la conservation des denrées périssables à l'A. F. F.), in the *Revue général du Froid et des Industries Frigorifiques*, Year I, Vol. I, No. 12, pp. 397-398. Paris, Dec. 1920. — II. Organisation de la production des produits d'œuf à Shanghai, *Ibid.*, p. 398.

The author describes the freezing of liquid eggs as an industrial means of preservation. The frozen eggs of commerce (hen's eggs and sometimes duck's eggs) are prepared in China, Japan and North America.

The plant required includes: — 1) Cold storage to preserve the eggs, before they are broken, at a temperature of 0° to +4° C; 2) a testing room kept at a temperature of +10° to +13° C.; 3) a well-lit breaking room at a temperature of +15° to +18° C.; 4) a freezing chamber with a temperature of between —12° and —18° C.; 5) a room for washing and sterilising the utensils. All the apparatus is in non-rusting metal and capable of standing daily sterilisation without deterioration.

Eggs freeze at about —3° C.; the shell cracks and lays bare the membrane inside the shell, which renders the egg very vulnerable and easily invaded by microbes when thawed. To avoid these defects it is better to get rid of the shells of eggs to be frozen.

The worker breaks the eggs one at a time by striking the egg against the sharp edge of a metal blade. The egg is emptied into a glass, so that a bad egg which has escaped the test con be eliminated. An experienced worker can break and empty 12 to 16 eggs a minute. The yolks are mixed with the whites, or they are kept separate; the yolks can have sugar (1 %) or salt (0.7 %) mixed with them. The liquid eggs are placed in tins which usually contain 13.5 kg., the tins are soldered and then taken to the freezzing chamber, where, they remain for about 36 hours at a temperature of from —12° to —18° C. Preservation is subsequently effected in cold storage, with or without ventilation at —6° or —8° C. Preservation can be prolonged for a year or more; it is, however, noticed that in this case the product thickens slightly and sometimes a slight oily film forms on the surface.

REDFIELD has made a detailed study of the variations in the composition of frozen eggs produced under various conditions; from his paper are taken the figures reproduced in the Tables below. The results are indicated in gm. per 100 gm. of fresh material.

The ammoniacal nitrogen is expressed in milligrammes per 100 gm. of fresh material; the acidity of the fats in cubic centimetres of alcoholic soda N/20 per gramme. The counting of the bacteria was done after 5 days' culture at 20° C.

II. — An American company, the "Amos Bird Co." at Shanghai deals daily with one million eggs. The yolks and whites are dried and frozen, or frozen only. These products are sold in America. The factory employs 700 workmen and the processes of manufacture are kept secret.

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(1) See *R.*, Aug. 1916, No. 918; Dec. 1916, No. 1224; July-Sept. 1919, No. 1015. (*Ed.*)

Whole eggs (whites and yolks mixed).

	Eggs opened aseptically		Commercial product
	Fresh	Preserved for 4 to 13 months	
Dry material %	25.96 to 27.19	27.88 to 29.34	25.81 to 30.30
Ether extract %	9.31 – 11.01	10.52 – 10.88	9.66 – 12.71
Reducing sugar %	0.29 – 0.36	0.31 – 0.41	0.27 – 0.33
Acidity of the fats	1.21 – 1.72	1.50 – 1.83	1.59 – 1.99
Ammoniacal nitrogen %	1 – 2 mg	2.6 – 3.2 mg	1.6 – 2.8 mg
Total bacteria (per gramme)	0	0	70 000 – 15 millions
Bact. coli	0	0	100 – 1 millions

Yolks.

	Eggs opened aseptically		Commercial product
	Fresh yolks	Yolks preserved for 4 to 13 months	
Dry material %	46.93 to 50.90	39.43 to 43.87	43.10 to 44.84
Ether extract %	24.49 – 28.78	19.24 – 22.74	22.18 – 23.69
Reducing sugar %	0.08 – 0.20	0.18 – 0.29	0.17 – 0.24
Acidity of the fats	1.44 – 1.96	1.53 – 1.82	1.80 – 1.99
Ammoniacal nitrógen %	2.5 – 3.1 mg	3.8 – 6.4 mg	4.0 – 4.4 mg
Total bacteria (per gramme)	0	0 – 87,000	24 000 – 5 300 000
Bact. coli	0	0	100 – 100 000

Yolks and whites separated.

	Sugared yolks	Whites. — Eggs opened aseptically	
	Commercial product	Fresh whites	After 4 to 13 months preservation
Dry material %	48.46 to 49.06	11.80 to 12.83	13.96 to 15.54
Ether extract %	17.94 – 18.65	0.01 – 0.12	10.03 – 0.07
Reducing sugar %	0.26 – 0.28	0.31 – 0.46	0.37 – 0.55
Acidity of the fats	1.04 – 1.19	—	—
Ammoniacal nitrogen %	3.1 – 3.7 mg	0 – 1.2 mg	0.4 – 0.8 mg
Total bacteria (per gramme)	220 000 to 950 000	0	0 – 100 000
Bact. coli	1 000 to 10 000	—	—

767 - **The Frozen Meat Industry in Brazil** (1). — *La Revue générale du Froid et des Industries frigorifiques*, Year II, Vol. II, No. 3, pp. 87-81. Paris, March, 1921.

The frozen meat industry in Brazil is of quite recent date, since it began in 1914; the first consignment to London, 1415 kg., was made in December of that year by the Osasco and Barretos packing houses in the State of São Paulo.

During the war the enormous demand for frozen meat required for the Allied armies gave this industry a remarkable impetus; the following statement shows the total shipments from Brazil each year up to 1920:—

	Tons shipped	Values in thousands of paper *milreis* (1)
1914	1 415	—
1915	8 514	6 121
1916	33 661	28 192
1917	66 452	60 233
1918	60 508	60 755
1919	54 094	60 183
1920	63 600	67 213

(1) 1 paper *milreis* = 16 *pence*.

From an examination of these figures it would seem that the demand due to the war resulted, as principal effect, in the sudden creation of the meat industry and that this industry, which has now reached the stage of regular production, shows a tendency to develop normally, the price of Brazilian meat tending at the same time to keep level with those of other similar markets.

Statistics of 1913, based on an official census of cattle in the various States of Brazil, gave a grand total of 30 705 080 head. The States which had most cattle were:— Rio Grande do Sul, with 7 249 000 head; Minas Geraes, with 6 861 000 head; Bahia, with 2 683 000; Matto Grosso, with 2 050 000 head; and S. Paulo, with 1 322 000 head.

These figures are no longer accurate, the cattle in certain States in Brazil having considerably increased since 1913. Thus, according to recent information, Rio Grande do Sul has at present more than 8 million cattle, Minas Geraes about 7 500 000, S. Paulo 3 803 205. These are the three States in which cattle breeding has been specially developed and improved by the introduction of well bred bulls.

These would be no exaggeration in fixing the present number of cattle at 35 million head (2).

In 1913, the total number of cattle in Brazil and other cattle breeding countries in decreasing order of importance were as follows, in millions of head: — United States 63; Russia 37.3; Brazil 30 705; Argentine 29; Germany 20.15; Austria 17.8; France 14.5; England 11.8; Algeria and Tunis 11.3; and Canada 10. In the same year the average price of an average steer was:—

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(1) See *R.*, May, 1915, No. 530; June, 1915, No. 623; August, 1915, No. 733; March, 1919, No. 339; Feb., 1921, No. 213. (*Ed.*)

(2) An estimate made in 1918 gave: — 37 500 000 head of cattle, 7 205 000 sheep and 17 320 pigs. (*Note by the Ed. of the Revue Générale du Froid*).

United States	300 to 350 *milreis*
Argentina	225 to 250 »
Brazil	120 to 130 »

It cannot be said that any breed properly speaking is found in Brazil, and all efforts of breeders are directed towards the creation of a breed by crossing and selection.

The cattle in Rio Grande and Minas Geraes are generally cross-bred with imported cattle on one hand and with indigenous " caracu " (1) and " zebu " (2) (the latter chiefly in the State of Minas Geraes).

The weight, height and yield are small. An average steer does not weigh more than 300 to 500 kg.; the bones are much developed and scarcely 220 to 250 kg. of meat net are obtained.

Up to the present the efforts of breeders in the south have been generally very scattered. The want of concentration and especially the mistake formerly made, notably in the State of Minas, of mixing the breeds of " zebu " and " criolla " (cattle of foreign origin living almost wild) has been one of the chief obstacles to the production of a fixed type.

For several years the Federal Government (3) has been making greater efforts to introduce well-bred bulls into the country. It has instituted bonuses for breeding, allowed duty-free importation of bulls, and encouraged cattle shows and fairs. The Minister for Agriculture has recommended the following measures as capable of giving good results:—

1) *Restriction in the importation of bulls to two or three breeds at most* (Shorthorn, Polled Angus, Hereford) with the object of improving the live weight of the cattle. On its part the Union of Breeders of Rio Grande do Sul recommends, for cattle intended for slaughter, that after experimenting, one or other of the three breeds should be definitely adopted so as to create a fixed breed by the introduction of a single strain in the indigenous cattle.

2) *Generalising the practice of keeping cattle in pens.* — Up to date Brazilian breeders have been content to import bulls and let them run free among the herds in the open all the year round. It was soon discovered, and this was notably the case with cattle belonging to the Brazil Land, Cattle and Packing Co., that these bulls, imported into Brazil at great cost, could not stand the diseases which raged in the country:— foot and mouth disease, red water, anthrax, etc.

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(1) See *R.*, Nov. 1917, No. 1044.

(2) See *R*, Jan. 1915, No 80. (*Ed*)

(3) See No. 700 of this *Review*. (*Ed.*)

The Union of Breeders of Rio Grande do Sul considers that the present methods of keeping cattle must be brought up to date, recourse had to preventive measures (arsenical dips or injections of trypanoblue against ticks or " carapatos „), shelters provided for the animals where they can be visited, cared for, or placed under observation.

3) *Gradual elimination of the " zebu " breed.* — The breeders of Southern Brazil have pronounced clearly against cross breeding between imported cattle and the " zebu " breed, the produce so obtained being inferior in yield and degenerating more and more.

The question of natural or artificial pasturage is secondary.

There is no doubt that in this matter Brazil is particularly fortunate. Enormous stretches of land, selling at very low prices, are found in the north of Parana and Rio Grande do Sul, or the borders of Parana and Paraguay, as far as Matto Grosso, abundantly watered and situated at a sufficient altitude to furnish excellent pasture although the grass there is, apparently, fairly hard.

The frozen meat from Brazilian cattle has been recognised as capable, as regards quality, of comparison with the best Argentine, Uruguayan, Australian or Canadian meat on the English and French markets.

Argentine cattle yield on an average 500 kg. of meat per animal, whereas in Brazil the average barely reaches 250 kg.

Consequently the 30 million head of cattle in Brazil only represent in utilisable weight, compared with the 29 million head of Argentine cattle, some 15 million head actually.

As, on the other hand, the home consumption is greater in Brazil than in La Plata, the first deduction to be drawn from these facts is that the present condition of the Brazilian herds is a long way from showing a potential annual export equal to that of the Argentine, which amounts to about 600 000 metric tons. With the generally primitive methods of keeping cattle in Brazil and the mortality which is thus caused, it is not possible to estimate a higher average annual production than 10 % (1).

The possible export would be about 700 000 head, which at an average weight of 250 kg. per head, would give a total of 175 000 tons of meat. At 1000 *reis* a kg. this tonnage would represent a value of 175 000 *contos de reis*.

At present the capacity of industrial production is far from reaching this amount. At the present moment, there are in Brazil 12 undertakings engaged in the production and preservation of frozen meat, of which 10 are working, distributed as indicated in the table on p. 921.

The first nine establishments in working are controlled by the Federal Government and the last by the Municipality of Rio de Janeiro, During

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(1) This percentage seems too low, for many Brazilian cattle breeders state that they can count on a production of 20 % and even 25 % for those who use the more rational methods; 18 % would seem to be an accepted average which corresponds to an export of of 1 260 000 head and 315 000 tons of dressed meat. (*Note by the Ed. of the Revue Générale du Froid*).

Designation	Number of cattle killed in 1918
State of São-Paulo :-	
Continental Products Co., at Osasco. (Daily possible slaughter :— 1000 steers, 2000 sheep, 4000 pigs. — Workmen :— 650).	108 413
Companhia frigorifica e Pastoril, at Barretos. (Capacity :— 900 tons. — Workmen :— 300).	39 949
Companhia frigorifica de Santos, at Santos. (Daily slaughter :— 350 steers, 500 pigs ; capacity :— 800 tons. — Workmen :— 130).	9 685
Frigorifico Armour do Brazil, at Lapa near São-Paulo . . . . (Only working since July, 1920 ; daily possible slaughter :— 200 steers, 3000 pigs and 600 sheep. — Workmen :— 600).	
Total . . .	**158 047**
State of Rio Grande do Sul (built in 1917-18) :—	
Companhia frigorifica do Brazil, at Sta. Anna do Livramento	1 889
Companhia Swift do Brazil, at Rio Grande . . . . (Daily slaughter :— 1000 steers).	4 144
Companhia Armour do Brazil, at Sta Anna do Livramento. (Daily slaughter :— 1000 steers ; capacity :— 1500 tons).	48 606
Frig. Pedro Oscrio, Abreu e Cia, at Tupaceretam.	21 268
Companhia Swift do Brazil, at Rosario . . . . (Capacity :— 8600 tons).	96 538
Companhia frigorifica nacional Rio Grande, at Pelotas (Not yet working)	
Total . . .	**172 445**
State of Rio de Janeiro :—	
Brazilian Meat Co., Ltd., at Mendés	60 519
Federal District : —	
Companhia brasileira britanica de carnes, near Rio de Janeiro (connected with the British and Argentine Meat Co., Ltd. capacity :— 6000 tons)	43 836
Grand total.	**434 847**

the first half year of 1919, 93 250 head of cattle were slaughtered at the Swift cold storage at Rosario alone. For the year 1919 the export of chilled and frozen meat was as follows, for the 3 great ports of shipment :—

Rio de Janeiro	15 260 tons	54 094 metric tons.
Santos	32 034 »	
Rio Grande do Sul	6 800 »	

The following is some supplementary information (1) regarding the refrigerating establishments in the State of São Paulo (not including that of Armour and Co.) for the year 1918 :—

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(1) This information and part of that given previously is due to M. Paul WALLE, Councillor for foreign Commerce, General Secretary-Treasurer of the Franco-Brazilian Chamber of Commerce, at Paris. (*Note by the Ed. of the Revue Générale du Froid*).

	Number of animals killed	Dead weight in metric tons
Cattle	204 011	42 400
Pigs	31 215	1 706
Sheep	2 526	35

Production of dressed meat (in tons).

	Factory at Osasco	Factory at Barretos	Factory at Santos	Totals
Frozen meat	18 501	9 489	1 705	29 695
Chilled »	1 046	4 209	—	5 255
Fresh »	—	—	—	4 372
Preserved »	2 751	44	—	2 795
Value in *contos* *	34 000	15 189	6 985	56 174

* 1 *conto de reis* = 1000 *milreis*.

For the State of São-Paulo, the exports of chilled meat, from 1916 to 1920, were as follows:—

Years	Metric Tons	Value in *contos*
1916	18 689	15 717
1917	29 315	26 388
1918	32 655	32 757
1919	30 731	33 805
1920 (11 months)	34 000 about	35 917

There is still a great difference between the actual figures and what might be expected. The problem of improving the breed is well on the way to being solved but the problem of shipping remains to be dealt with before this industry can be fully developed in Brazil.

As the best breeding areas are certainly Rio Grande do Sul followed by Matto Grosso and Minas Geraes, for which the port of shipment is Rio de Janeiro, it is not expecting too much to anticipate that the export from these three States will quickly reach 100 000 tons, but on condition that this quantity can be transported to the European markets by regular and sufficient lines of ships with cold storage. There, apparently, lies the kernel of the matter for, at present, the transport capacity for frozen meat is certainly not adequate to the production.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

768 – **On the Identity of *Spirospora Castaneae*, a Hyphomycete Observed on Chestnuts in France — and *Acrospeira mirabilis*** — PEYRONEL, B, in the *Bulletin trimestriel de la Société mycologique de France*, Vol XXXVII, Part 1, pp 56-61, Paris, April 15, 1921

A short time ago, MM. MANGON and VINCENS described, under the name of *Spirospora Castaneae* n. gen. and n. sp, a hyphomycete found in France on Chestnuts affected by black rot » (1). They thought that the perfect form of *Spir. Castaneae* might be a member of the genus *Melanospora.*

The author states that this hyphomycete is not a new species, for it was discovered and accurately described, at least under its chlamydospore form, as long ago as 1857, when it was found, also upon chestnuts, at Bristol (England) by BERKELEY and BROOME, who gave it the name of *Acrospeira mirabilis.*

The author adds that this fungus cannot be very uncommon, seeing that since 1916 — when he began to study the diseases of chestnuts — he found it frequently every year in Rome during the autumn and winter. In any case, it is very widely spread, for according to BERKELEY and BROOME, many mycologists have met with it in other European countries, and in South America.

Spirospora Castaneae Mangin and Vincens (1920) should thus be regarded, according to the author, as a synonym of *Acrospeira mirabilis* B. and Br. (1857), as well as of *Polycystis italica* Sacc. and Speg. (1879) *Urocystis ? italica* (Sacc. and Speg.) De Toni (1889), and *Stephanoma italicum* (Sacc. and Speg.) Sacc and Trav. (1911).

769 – **Behaviour of Selected Todaro Wheats Towards Lodging and Rust in the Molise, Italy.** — See No 718 of this *Review*

770 – **" Kavangire " Variety of Sugar Cane Resistant to Root Rot.** — See No. 710 of this *Review.*

771 – **" Nosiola ", Trentino Vine Resistant to Anthracnose.** — See No 728 of this *Review*

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(1) See *R*, Jan. 1921, No 109 (*Ed.*)

772 - **Control of Diseases and Pests in Brazil.** — See No. 700 of this *Review*.

773 - **Fungous Diseases of Wheat in Sweden** — See No. 702 of this *Review*.

774 - **Norwegian Spring Wheat, Beardless with Light Ears, Very Susceptible to *Erysiphe graminis* and to *Tilletia Caries*.** — See No. 711 of this *Review*.

775 - **The Smut of Italian Millet (*Ustilago Crameri*) in the Presidency of Madras, India.** — SUNDARAMAN, S., in *Agricultural Research Institute, Pusa, Bulletin* No. 87, pp. 1-11, pl., 2 map, 1 Calcutta, 1921.

Italian millet (*Setaria italica*) is one of the most important food crops of the Presidency of Madras, where it is grown in all the districts, except Malabar and South Canara. This cereal is subject to several cryptogamic diseases, but the one that does it most injury in Madras is smut (*Ustilago Crameri* Koern).

In 1917, this disease assumed serious proportions in the « taluk » of Siruguppa (Bellary district). The loss due to the fungus was estimated at more than one quarter of the whole crop.

According to the author, of all the preventive measures so far known, copper sulphate is the best, being both the cheapest and surest.

It was found by his experiments, that in distilled water the chlamydospores of *Ustilago Crameri* germinate in the proportion of 50 % in six hours ; 95 % germinate in twelve hours, and 100 % in twenty-four hours. If placed in a 0.5 %, or stronger, solution of sulphate of copper for fifteen to thirty minutes, none of these spores germinate.

As regards the effect of copper sulphate upon the germination of the millet seed, the author's experiments proved, that it was hindered by immersion for thirty minutes in 5 % copper sulphate solution, and for fifteen to thirty minutes in a stronger solution.

Practically, all that is needed to protect the seed from the attack of smut, is to place it for half an hour in a 2 % solution of copper sulphate.

Only seed in good condition should be used, old millet is liable to be injured by the treatment. The disinfected grain should be immediately dried, to prevent its germinating, and planted at once.

776 - **Diseases of Sweet Potato in the United States.** - - See No. 719 of this *Review*.

777 - **Diseases of Cotton in Brazil.** — See No. 700 of this *Review*.

778 - ***Alternaria Nelumbii* n..sp., a Hyphomycete Injurious to the Nympheacea, *Nelumbium speciosum* in the United States.** - ENLOWS, E. M. A., and RAND, F. V., in *Phytopatholo y*, Vol. XI, No. 3, pp. 135-140, figs. 1, pl. 1. Lancaster Pa., March 1921.

A cryptogamic disease of the leaves of the Egyptian lotus (*Nelumbium speciosum*), was first observed in 1913, at Kenilworth (District of Columbia), and later, at the New York Botanical Garden The disease begins as very small, smooth, reddish-brown spots, which increase in size, until they reach 5 to 10 mm. in diameter. They may be roundish, or somewhat irregular in shape, with a tendency towards the formation of concentric bands of alternately lighter and darker brownish tissue. The margin is definite. In some cases, the spots are surrounded by a lighter green halo. When the spots are very numerous, many of them coalesce, and the leaf gradually dries from the margin inward.

Since 1913, the disease has been seen at Riverton (New Jersey), again at the New York Botanical Gardens, and Kenilworth, at Arlington (New Jersey), and at Pittsburgh (Pennsylvania).

The same fungus, which from its characters appears to belong to the genus *Alternaria*, was isolated several times from diseased leaves collected in the above-mentioned localities. The results of numerous inoculations carried out upon detached leaves in the laboratory, as well as on plants of *N. speciosum* under normal conditions, in the greenhouse and out of doors, leave no doubt of the pathogenicity of this species of *Alternaria* to the Egyptian lotus.

No perfect stage of the fungus has yet been discovered, but the fact that its conidia are able to germinate after remaining dry in the laboratory for as long as 2 years, would certainly indicate, that the conidia are probably carried over winter on dead leaves, and other débris. This micromycete grows well saprophytically, so it is also possible that it might continue growing on fallen leaves during the warmer periods of the winter.

The fungus in question is considered to be a species new to science, and is described under the name of *Alt. Nelumbii.*

779 - ***Trichothecium roseum*, a Hyphomycete Producing " Marciume amaro " (Bitter Rot) or " Marciume del cuore " (Core Rot) in Apples and Pears, in Italy.**

— PEYRONEL, B., in the *R Stazione di Patologia vegetale e R Osservatorio fitopatologico per la provincia di Roma e gli Abruzzi, Bollettino mensile d'informazioni e notizie*, Year II, Nos 1-4, pp. 23-27, figs 3. Rome, 1921.

Many of the apples and pears sold in the markets of Rome are found every year to be affected by a disease Although the fruits look perfectly normal and healthy externally, the pulp surrounding the loculi is brown, soft and rotten. During the first stages of the disease, a kind of spider's web, which subsequently gives place to a pink efflorescence, is seen on the interior of the loculi, and on the surface of the pips

Microscopic examination has shown this spider's web and efflorescence to be, respectively, the mycelium and conidial fructifications of a very common hyphomycete, *Trichothecium roseum* Link (= *Cephalothecium roseum* Corda) which frequently occurs on all kinds of dead and decaying plant matter, and usually behaves as a saprophyte. The fibrous tissue bounding the cavity of the style and connecting the loculi with the cavity of the calyx, is also altered and brown, and the rot gradually extends to the surrounding pulp. In the end, the entire fruit can become affected, and if the surroundings are not excessively damp, it is mummified. The diseased pulp is very bitter. Fruits attacked by this malady have been frequently sent from different places in Italy to the Station of Plant Pathology in Rome.

In the case of the fruits in question, it is clear that the fungus finds its way into the interior by way of the cavity of the calyx; it probably at first lives as a saprophyte; afterwards making its way along the hollow style, it reaches the core, and thence passes to the pulp. Sometimes, however, in the case of apples, the fungus reaches the loculi by way of the peduncle, following the course of the fibro-vascular bundles of the latter. According to the author, it is most probable that the germination of the conidia and the penetration of the mycelium are assisted by the habit of placing the choicest fruits — which are most often attacked — on a horizontal plane with the cavity of the calyx turned downwards. In this way, if the fruit is not perfectly dry, an actual moist chamber is made, in which any spores present on the skin can grow under excellent conditions. Piles of fruit also are easily attacked by the hyphomycete, especially if they are damp. The fruits should be kept perfectly dry, in dry rooms, and spread out, not piled one upon another.

780 - ***Phoma citricarpa*** **a Deuteromycete Parasitic on *Citrus sinensis* and *C. nobilis* in China.** — LEE, H. A., in *The Philippine Journal of Science*, Vol. XVII, No. 6, pp. 635-643. Manilla, 1920.

The same disease which was recorded in 1899 as occurring on the fruit of certain citrus trees in New South Wales (Australia), and attributed to the parasite *Phoma citricarpa* Mc. Alp. has recently been observed on the fruits of *Citrus sinensis* and *C. nobilis* in China, at Canton, Hongkong, Swatow, Amoy and Foochow. Infected specimens coming from Shanghai were intercepted at Nagasaki (Japan), and Chinese fruits severely affected by the disease have been collected on the market at Manila (Philippines). Citrus fruits grown in the Philippines have, however, so far, not been found to be infected

Small reddish-brown spots first appear on the surface of the diseased fruit, with increasing age, these spots become darker, and sometimes turn completely black. The spot may be 1 or 2 mm. in diameter, but can subsequently spread to from 7 to 9 mm. in diameter. As the spot matures, a reddish-brown, raised margin forms round the outer edge, while the centre sometimes becomes depressed and assumes a light-tan or brownish colour. Pycnidia occasionally show in this light-coloured area; they are black and extremely small (only a fraction of a mm. in diameter).

The lesion occurs not only on the surface of the fruit, but extends into the skin-tissue for 1, or at most, 2 mm In this internal tissue, the lesion is usually reddish-brown; it has never been observed to extend into the fruit, although, rarely, secondary rots emanating from a lesion due to the fungus in question may spread into the pulp. The disease is not widespread on fruits in the orchard, but seems to develop while they are in storage, or in transit to market. The presence of the spots on the fruit lessens its selling value.

Isolation experiments were first made at Nagasaki, and a fungus was invariably obtained. Subsequently isolations were also made from Chinese fruits found on the Manila markets, and in this manner, a fungus was isolated, which proved to be identical with the one obtained at Nagasaki, and answered closely to Mc Alpine's description of *Ph. citricarpa*.

Inoculation experiments carried out at Manila with a pure culture on sound, ripe oranges resulted in the reproduction of the disease. Control punctures with tap-water remained entirely negative The fungus has been re-isolated from positive lesions. Inoculation experiments have been repeated several times, and a reasonable percentage of positive results produced, thus proving that *Ph. citricarpa* is the cause of the disease recorded in China.

There are no experimental data regarding the control of this disease in an infected orchard The inoculations made have shown, that fruits are only susceptible when approaching maturity; unripe fruits yield negative results when inoculated.

It is possible, that the disease could be easily controlled by spraying. For countries where the malady is not yet present, the best control is, of course, to exclude it by quarantine measures.

The situation in the Philippines with regard to this disease is peculiar; as has already been said, it has not yet been seen on Philippine-grown oranges. Those imported from China, and found everywhere on the markets, are sometimes severely attacked by the fungus, and afford a source of infection for Philippine citrus fruits just at the period when the latter are ripening. The absence of the disease in these islands is therefore probably due to climatic conditions, or possibly to the fact, that ordinarily the rind of the Philippine citrus fruits does not mature and turn yellow, but remains green up to picking time. This point may be cleared up in future experiments.

INJURIOUS INSECTES AND OTHER LOWER ANIMALS

781 - **Indigenous *Gossipium* spp. in the Philippines Resistant to *Anthonomus grandis*.** — See No 722 of this *Review*

782 - **Insects Injurious to the Sugar Cane in Cuba.** — BARRETO, B T, in the *Revista de Agricultura, Comercio y Trabajo*, Year III, No 10, pp 371-374, figs 5 Havana, 1920

On an estate at Jagueyal (Commune of Ciego de Avila), all the sugar-cane fields contained small patches where the plants had been destroyed. These patches seemed to increase in size from one year to another. On the sugar-canes being examined, a large number of *Pseudococcus sacchari* and of *Ps. calceolariae* were found on the lower surfaces of the leaves, and on the roots

Practically the whole field was infested with these insects, but only about 15 to 20 % of the canes had been attacked. In places where there were most insects, the plants appeared to have succumbed to the attack of both species. The chief injury had been done in the case of canes that had been planted, to fill up the gaps. The small pieces of cane, on removal from the ground, were found to be infected with *Pseudococcus* which covered all the buds and shoots; the insects were probably already present on the canes before they were planted. On inspecting those that had not yet been used, many *Pseudococci* were found clustering round the buds.

It is probable however, that the death of the plants was due to other causes also. In some cases, indeed, the plantations had been cut over twelve times, and the stems were almost at the level of the soil, and weakened by the frequent action of fire.

Other insects had also been observed in the diseased plantations and in some of them large numbers of the eggs and larvae of Scarab beetles were found, as well as other intruders.

In certain of the sugar-cane fields on the same estate, great quantities of termites were also discovered; these insects, however, do not seem to have been responsible for the death of the plants.

The best means of controlling the sugar-cane scale-insects is to burn the field, and plough it thoroughly; this should, however, only be resorted to in extreme cases, when the plantation is infested.

Periodically cleaning the ground, in order to prevent the spread of likely host-plants, is also an excellent way of ridding the field of the pests.

A field that has been burnt should not be replanted under two months, and it is wiser to wait a year.

Further, only canes completely free from scale-insects should be used for planting and if there is any doubt about the matter, they should be disinfected by immersion for half-an-hour in a solution of whale-oil soap.

Aspergillus flavus, one of the natural enemies of *Pseudococcus* in Cuba, was not present in large numbers on the estate in question. It was not possible to determine how far species of *Polistes* were useful in controlling scale-insects. In some fields that were infested with the latter, numerous larvae of the coccinellid *Cryptolaemus montrouzieri* were liberated by way of experiment, but little faith is placed in their efficacy.

For the control of scarabs, the soil should be worked from January to March; the larvae uncovered can be picked up, or left for the birds, which devour them readily. The adult beetles, which feed on the leaves of the fruit trees at dusk, in May and June, ought to be shaken down into cloths spread below, and then collected and thrown into vessels containing petroleum.

When it is known which trees are visited by the adult coleoptera, they can be sprayed with a solution of lead arsenate, so that the insects are poisoned on eating the leaves.

Light-traps can also be used for adult scarabs; if these are suitably arranged, great numbers of the insects are attracted and caught in the early spring.

783 – ***Pyrausta ainsliei*** **a Microlepidopteron Parasite of** ***Polygonum*** **spp. in the United States — Closely Resembling the Maize Pyralid (*Pyr. nubilalis*)** (1).

— Ainslie, G. G., and Cartwright, W. B., in *Journal of Agricultural Research*, Vol. XX, No. 11, pp. 837-844. Washington (D. C), March 1, 1921.

Observations made since 1912 in Tennessee, and the neighbouring States, have shown, that the Smartweed Borer (*Pyrausta ainsliei* Heinrich), is of no importance as a pest. At present, however, the insect is of considerable interest because of its resemblance, both in habits and appearance, to the maize pyralid (*Pyr. nubilalis* Hübner). Until recently, it has also been confused with *Pyr. penitalis* Grote, which feeds on *Nelumbium luteum.*

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(1) See *R.* Oct.-Dec 1919, No. 1289; *R* April 1920, No 471. (*Ed*)

The Smartweed Borer is known in the following States: Massachusetts, New York, Pennsylvania, Ohio, Illinois, Tennessee, Kentucky and South Carolina. It is possible that its geographical distribution is still more extensive.

Polygonum pennsylvanicum is the chief plant upon which its caterpillars feed, though they have also been found inside the stems of other related species The larvae have also been reared upon the leaves of the curled dock (*Rumex crispus*) and buckwheat (*Fagopyrum fagopyrum*), which are close relatives of *Polygonum.*

The stems of many other species (maize among the number), afford shelter to the caterpillars during the winter, but they obtain no food from these plants.

The article analysed contains much information regarding the life-history and habits of *Pyr. ainsliei.*

The latter varies greatly in abundance from year to year; this seems to be due, in Tennessee at least, to variations in the natural enemies of the microlepidopteron.

The most important of the latter appears to be (*Panzeria*) *Pyraustomyia penitalis* Coq. Other parasites found on the Smartweed Borer are *Cremastus facilis* (Cresson), and three apparently distinct hymenoptera, one of which has been determined as *Microbracon* sp. The larvae of *Callida decora* Fab. and of *Chauliognathus pennsylvanicus* de Geer are predatory insects, that have been mentioned as attacking it.

784 - **Insects Injurious to Medicinal Plants in the Crimea.** — PARFENTJEV, I., in the *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 3, pp. 614-167, figs. 5 Paris, 1921.

The results of entomological researches made from 1919-1920 on crops of medicinal plants cultivated at the Fruit-Growing Experiment Station of Salghir, which is situated in the vicinity of the town of Simferopol.

Atropa Belladonna, unlike *Ricinus*, is much injured by insects. The adult forms of *Epithrix atropae* and *E. pubescens* make small, more or less round holes in the leaves of the former plant, which finally look like sieves. These beetles also attack plants of belladonna growing wild in the forests of the Crimea. The females of the genus *Epithrix* deposit their eggs during summer directly on the ground, and the larvae hatch out after seven, or eight, days and remain in the soil, where they pupate, the adult insect appearing on the 6th or 7th day after pupation.

Psylliodes hyoscami, which is sometimes seen on *Atropa Belladonna* occurs more frequently on the common henbane (*Hyoscyamus niger*).

The leaves and flowers of *Atropa Belladonna* are sometimes attacked also by the caterpillars of *Mamestra brassicae* and *Heliothis peltigera.*

The adult form of *Ceuthorrhynchus macula-alba* perforates the capsules of *Papaver somniferum* which are arrested in their development, and bend over. The larvae of this insect live inside the capsules.

Podagrica malvae bores small, irregular holes in the leaves and flowers of the marsh-mallow and the holly-hock. The reproductive organs of the marsh-mallow are devoured by *Oxythyrea funesta.* The holly-hock is also attacked by *Baris nitens, Apion longirostre,* and *A. validum,* the larvae of the two last insects living in the seeds and the stems of the plant respectively.

The flowers of the fennel are attacked by several Hymenoptera, Diptera, and Coleoptera. *Graphosoma lineatum* does considerable injury by sucking the fruits.

The adult forms of *Cassida viridis* and *Cryptocephalus ocellatus* perforate the leaves of balm (*Melissa officinalis*).

The flowers of wild plants of *Adonis vernalis* are often injured by *Amphicoma vulpes.*

785 - *Rhagium lineatum*, a Coleopteron Injurious to Pines in North America.—

HESS, W. N., in *Cornell University, Agricultural Experiment Station, Memoir* 33, pp. 367-381, figs. 6, pl. 1. Ithaca, New York, 1920.

Rhagium lineatum Oliv. is one of the commonest and most widely distributed species od Cerambycides in North America

It has been reported from Canada, twelve States of the North American Union, and Mexico.

In the state of New York, and in Pennsylvania, all species of pine are attacked by this beetle, although it most frequently chooses *Pinus Strobus, P. rigida,* and *P. resinosa.*

Although the attack is limited to the region of the inner cortex, and outer sapwood, there is no doubt, that the insect does great damage to the recently dead wood. It generally makes extensive galleries, which lead to the bark becoming detached, and the damp gaining access to the interior of the tree Once the moisture has succeeded in effecting an entrance, it is retained by the large mass of wood fragments produced by the excavations of the beetle, the growth of fungi is thus promoted, and the decay of the tree hastened.

The tree attacked dies after the second or third year; the exits made by the adult insects permit of the entrance of large quantities of water, as well as of other insects, and fungi, which soon render the wood useless for commercial purposes.

The author gives a full morphological and biological account of the different stages in the development of *Rh. lineatum.*

As regards the control of the latter, a wet season, not only hinders its work of destruction, but is also favourable to the growth of fungi which attack the beetle at every stage, and especially the larvae. Individuals surviving until the winter often succumb to frost. The larvae on hatching out, while seeking an easy way to reach the inner cortex, often fall a prey to other insects, or to birds.

Atanycolus simplex Cresson, a parasite of the larvae of *Rh. lineatum*, was reared in Pennsylvania, the number of larvae attacked by it being estimated at 5 % In the State of New York, this parasite is extremely rare, and only attacks about 1 %.

The pest could be artificially controlled by felling all the pines recently killed, and removing the bark before March 1. The larvae and adult insects would thus be destroyed, and this would contribute greatly to reducing subsequent attacks Trees lately felled can be protected against *Rh. lineatum* by putting them into water. The attacks can be greatly decreased by placing the trunks in damp surroundings, but this may also hasten the decay of the wood The application of repellent substances, like carbolineum, in May, as a rule prevents oviposition on the part of the females of this beetle.

Only a few years ago, these pests were extraordinarily plentiful in the environs of Ithaca (New York) ; recently however, *Rh. lineatum*, and many other insects which were most injurious to forest trees, have almost disappeared. This is due in a great measure to the fact, that all dead, or dying trees, have been at once felled and removed.

786 - ***Neodiprion lecontei*, a Hymenopteron Attacking Pines in the United States.** — MIDDLETON, W, in *Journal of Agricultural Research*, Vol. XX, No 10, pp. 741-760, figs 3, pl. 5 Washington, D. C, February 15, 1921.

A very detailed morphological description of the various stages of Leconte's sawfly (*Neodiprion lecontei* (Fitch) — a hymenopteron belonging to the family Tenthredinidae, sub-family Diprioninae — followed by a short acount of the life-history of the insect.

The latter has hitherto been found in the following States of North America North Carolina, Conneticut, the District of Columbia, Florida, Louisiana, Maryland, Michigan, Mississippi, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, West Virginia, Wisconsin.

The hymenipteron appears to have three primary, or preferred, hosts : Jack pine (*Pinus Banksiana*), red pine (*P. resinosa*) and scrub pine (*P. virginiana*). Its secondary, or possible hosts are white pine (*Pinus strobus*) Scotch pine (*P. sylvestris*), loblolly pine (*P. Taeda*), shore pine (*P. contorta*), silver pine (*P. monticola*), mugho pine (*P. mughus*), *P. eldarica*, western yellow pine (*P. ponderosa*), longleaf pine (*P. palustris*), Austrian pine (*P. austriaca*), and American larch (*Larix americana*).

The larvae of *N. lecontei* do considerable damage to both natural reproduction and nursery stock by defoliating the trees. The complete, or nearly complete, defoliation before late summer usually kills the part stripped, and since these insects show a very decided preference for young trees, the larvae are often numerous enough to entirely deprive the tree of all its leaves ; many young pines are killed by this means' alone. Trees not completely denuded frequently die because, in their weakened condition, they are attacked by secondary insect enemies. Where there is incomplete defoliation and the tree recovers, it is often stunted, or misshapen, and of little commercial or ornamental value.

Four species of Hymenoptera and four species of Diptera have been reared from the cocoons of *N. lecontei*, but neither egg parasites nor parrasites that emerged from uncocooned larvae have been obtained. The hymenopterous parasites observed were: *Exenterus diprioni* Rohwer, *Lagorotis diprioni* Rohwer, *L. virginiana* Rohwer and *Perilampus hyalinus* Say Of these parasites, *L. diprioni* Rowher is much the most abundant species, and *Perilampus hyalinus* Say is probably a hyperparasite. The dipterous parasites of *N. Lecontei* are: *Phorocera claripennis* Macquart, *Adomonita demylus* Walker, *Neopalus maera* Van der Wielp, and *Spathimeitenis spinigera* Townsend.

From what was observed, in 1912, at Wisconsin, the larvae of *N. lecontei* are also subject to a disease which is probably of bacterial origin, but it appears that none of the insect parasites were abundant enough, nor was the bacterial disease sufficiently distributed or infectious, to allow of the neglect of artificial control measures.

In large areas of either natural or artificial conifer reproduction, control cannot be generally practised on account of its expense, but rangers and lumber men should systematically destroy the colonies of this sawfly, whenever they are found. The easiest plan is to knock the larvae from the trees, and crush them with the foot.

In nurseries and parks, the control, in case of heavy infestation, can best be carried out before the larvae are full-grown, and should consist of thorough spraying. An arsenate of lead spray is very efficacious; if the larvae are quite young, nicotine sulphate is a fairly satisfactory spray. Since however, conifers are very resistant to arsenical sprays, and arsenical treatment gives the best result , the first treatment should be employed almost exclusively. In scattered infestations, hand-picking, or knocking the larvae down from the trees and crushing them, will be found more economical, and at least as effective.

Whenever these insects are observed in any locality, and control measures are practised against them, it is important that the territory should be carefully surveyed for the following 14 months, since it is possible, that some of the larvae may have survived, and have spun cocoons. This possibility makes it necessary to watch carefully throughout the entire colony-period of this sawfly, in order that an emergence of adults from the cocoons may not give rise to a new infestation.

[786]

ALFREDO RUGGERI, *gerente responsabile.*

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

787 - **Note on the Mountainous Regions of North Annam.** — POILANE (Chargé de prospection forestier), Official Statement from the Laboratoire de Botanique de l'Institut Scientifique de l'Indochine, in *Bulletin Agricole de l'Institut de Saigon*, Year III, No 6, Saigon, June 1921

The note begins with a short preface from the Botanical Laboratory of the Scientific Institute of Indo-China, describing the considerable amount of work which the author carried out in collecting, preparing, preserving and transporting nearly 3000 numbers (respresenting at a low estimate 30 000 botanical specimens) of woody and herbaceous species regarding each of which he patiently collected information such as could obtained from the natives themselves in each district visited It is to be hoped that this material, which has been sent to the Natural History Museum in Paris, will soon yield much scientific information regarding the less-known regions of Indo-China.

The itinerary of the journey through North Annam was approximately as follows: — Thanh-Hoa, Phu-Quan, Phong-Y, Hoi-Xuan, Hua-Tau, Ban-Inh-Dam, Na-Ham, Sam-Neua, Tam-La, Xieng-Khouang (Province of Tran-Ninh to Laos), Cha-Mung, and Muong-Sen.

The author gives much information on the indigenous flora, the forests, cultivation in the high regions with relatively temperate climate, where a fairly large number of European fruit trees (apple, pear, peach and cherry trees) are often found, and on various other natural sources of wealth (minerals, etc,). and on the manners and customs of the inhabitants of various races (Annamites, Moïs, Muong, Méos, Thôs and Laotiens).

All the mountainous zone of North Annam and Laos will have a fine future when means of communication are constructed to open it up.

788 - **Influence of the Size of Plots on the Accuracy of Field Experiments.** — KRISTENSEN A. K., in *Tidskrift for Planteavl*, Vol. XXVII, Part 4, pp. 681-692. Copenhagen, 1921.

The author continues his examination of the technique of field experiments relating to the researches of SCHNEIDEWIND and VAGELER (1). He discusses their results and draws certain general conclusions.

If fields bearing crops treated in a similar manner are divided into plots, the produce of which is weighed separately, it is found that small plots give much more accurate results than large, when the latter are obtained by reducing the number of duplicate plots Even if the area of the plots is increased thus increasing proportionately the total area, whilst the number of duplicate plots remains the same, the small plots still give more accurate results, and this is particularly noticeable for cereals.

In the case of weeded crops (red cabbage), the results were not so favourable with very small rectangular plots. These remarks, based specially on VAGELER's data, are equally applicable to those of SCHNEIDEWIND.

CORPS AND CULTIVATION

789 - **The Degree to which Plants can be considered as Integral Factors' Capable of Measuring the Complex Effect of Climatic Factors.** — I. LIVINGSTONE, P. A., in *Physiological Researches*, Vol. No. 5, pp. 217-288, figs. 4, 1914. — II. LIVINGSTONE, B. E., *Ibid.*, Vol. 1, No. 8, pp. 399-420, figs. 4, 1916. — III. HILDEBRAND, F. M., *Ibid*, Vol. 2 pp. 341-405, figs. 8. Baltimore, May 1921.

I. — LEHENBAUER has undertaken a series of very interesting researches concerning the effect of temperature on the growth of young maize plants. The results obtained by previous writers suggest thet the growth curve of plants, in relation to temperature, is very irregular, since it has two distinct apices instead of one. On the other hand, the data concerning the technical optimum vary considerably according to different authors, perhaps because the very important factor time of has not been sufficiently taken into account in this kind of research.

In the course of the experiments in question arrangements were made to obtain, as far as possible, uniform conditions; the young maize plants were kept in the dark and at a constant temperature, the re.ative humidity was always about 95 %, and lastly the time factor, in relation to the rate of growth at different temperatures, was taken into account. The biometric data were, in many cases, recorded every hour and the period of observation lasted from 12 to 39 hours, at temperatures of 12° to 43°C.

The chief conclusions may be summed up as follows: —

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(1) See *R.*, March 1921, No. 243. (*Ed.*)

1) There was only one thermic optimum. For maize in liquid cultures and for a period of 12 hours it was equal to 32°C.

2) Under these experimental conditions, the thermic optimum varies with the change of duration of exposure (see Table I)

3) At high temperatures the initial rate of growth is not maintained but diminishes considerably when the period of experiment is prolonged beyond a certain limit.

4) The decrease in the rate of growth, which is noticed at high temperatures makes it necessary, in every case, if the period of exposure is prolonged, to take into account the length of the periods which have served to determine that rate. The term *optimum temperature* has no meaning, at least in the case investigated, if the duration of exposure of the plant to that certain temperature has not been established with accuracy.

5) On the contrary, with temperatures which approach the minimum (12-14°C), even in the case of long experimental periods, no decrease in the rate of growth is noticed.

6) At intermediate temperatures the rate of growth obeyed the law of VAN T'HOFF, i. e, the rate was doubled by raising the temperature by 9 or 10°C.

II. — On the basis of the results obtained by the previous author giving exposures of young maize plants for a period of 12 hours at temperatures of 12° to 43°C., LIVINGSTONE was able to calculate a series of "thermo-physiological indices" which considerably facilitate the study of the growth of plants in relation to climatic conditions

LEHENBAUER'S data have been entered on a table of abscissae and ordinates, for drawing the corresponding curve; this curve was corrected later by LIVINGSTONE and prolonged by extrapolation to 2° and 48°C. These two values are considered as the extreme temperature of growth.

For each degree of temperature (both in the Centigrade and Fahrenheit scales) the corresponding ordinate, is measured (which gives the measure of growth per hour in hundredths of a millimetre), and the numbers thus obtained are divided by the value of the growth corresponding to 4.5°C. (40°F). The quotient represents exactly the "thermo-physiological index" of growth at the given temperature. Each index thus expresses the different growth for a given temperature, taking as unity the growth obtained by exposing the plant for 12 hours to a temperature of 4.5°C. Table II contains all the indices for temperatures in degrees C, from 12 to 47, and for temperatures in degrees F. from 36 to 118.

III. — Results of a series of parallel observations on the growth of soya beans and the course of meteorological factors. Th se observations were made simultaneously, during the summer of 1914 at 9 stations: — Oakland, Chewsville, Monrovia, College Park, Baltimore, Darlington, Coleman, Easton, and Princess Anna. The object of the observations was to establish in what degree and to what extent plants could serve as integral factors to give an idea of the course of the climatic factors, temperature, light and evaporation, as a whole. The same type of soil was used in every case, which unified the agrogeological conditions, and humidity was always maintained at 10-11 %, by means of a special automatic irrigator, so as to exclude the effect of rainfall, by placing constantly at the disposal of the plant the quantity of water necessary to the processes of growth.

Biometrical data recorded: — 1) Length of the stalk; 2) area of the leaf surface; 3) leaf product (length multiplied by breadth); 4) dry weight.

Two weeks after sowing determinations were made of: — 1) The average daily relative increase in length of the stalk for each plant (in mm.); 2) the average daily relative growth of the leaf area for each plant (in sq. mm.); 3) the average daily relative increase in dry weight for each plant (in grammes). (Sowing was carried out regularly every two weeks during the period of observation).

Meteorological data: — Temperature was expressed by means of thermo-physiological indices; for this purpose average daily temperatures are replaced by the corresponding index (see Table II), and the sum of the indices is divided by the number of days (14 or 28). Besides the thermo-physiological indices, the sums of the residual temperatures are calculated. The residual temperature is obtained by subtracting 3.89°C., from the average daily temperature.

Light: — The assumption is made that in a week there are *two* fine, *three* mixed and *two* overcast days. If the respective values 2, 1.5 and 0, are added up they give 3.5 the number equal to the total of fine days in the period considered. Now 3.5 is equal to the half (0.5) of the total number of days. The latter value, 0.5, which the author calls " coefficient of clear weather " is finally multiplied by the average intensity of insolation expressed in gramme calories per sq. cm.). The product obtained gives a fairly adequate idea of the phenomenon during the period considered.

Evaporation: — This is determined with an atmometer with a porous tank. The average daily evaporation in cc. is calculated for each period of 2 and 4 weeks.

The average daily growth of plants, as well as all the other biometric and climatic values, are expressed in the form of relative averages, with reference to the general average of all the data, and for all the stations for each period of 2 and 4 weeks. Directly comparable figures are thus obtained

To obtain the unit for each factor all the corresponding values (for example, all the daily averages of growth for two weeks at the 9 stations) are added together and then divided by th number of readings. This quotient serves as a comparative unit.

The daily averages, both climatic and biometric, are divided by this unit and the quotient is multiplied by 100 to avoid decimals.

The following are the units as calculated: —

2 weeks after sowing:—
Average daily increase in the height of the stalk per plant = 3.56 mm.
Average daily increase of the leaf product per plant = 112 sq. mm.

4 weeks after sowing:—
Average daily increase in the height of the stalk per plant = 3.20 mm.
Average daily increase of leaf area per plant = 122 sq. mm
Average daily increase of dry weight per plant = 6.29 gm.
Temperature = 13°50C.
Light = 442 gramme calories per sq. cm. of horizontal surface.
Evaporation = 16 cc

TABLE I. — *Data relating to the Station of Oakland for a period of 2 weeks*

	Iay 25 to une 5	June to June	June to July	July to July	July to July	July to Aug	August to August	August to Sept 1	Sept to Sept	verag
Number of cultures. . .	1		3	4	5	6	7	8	9	—
Length of period, in days.	13	14	14	13	15	14	13	16	13	—
Number of plants	4	5	5	6	5	6	6	6	4	—
Sum of the residual temperatures	334	354	401	364	431	369	343	370	212	**361**
Relative average daily thermo-physiological index . .	66	66	85	78	87	67	64	66	43	**69**
Average daily temperature in degrees Fahrenheit . . .	65	64	68	67	68	65	66	62	61	**65**
Relative average daily index of evaporation	153	130	98	79	104	90	71	57	60	**96**
Relative average daily intensity of insolation	122	122	109	103	116	102	110	83	81	**105**
Relative average increase in the length of the stalk .	76	96	124	84	96	98	101	53	42	**86**
Relative average increase of leaf product	—	81	87	71	81	78	82	40	—	**77**

The tables relating to the 4 week periods are worked out in the same way; only instead of leaf product, leaf area is taken into account, and, further, the data relating to the increase of dry weight are entered.

The data of the tables are graphically shown in a series of diagrams.

Table IV shows the average values of each biological index for the whole period of observation at each station.

From an examination of Table IV it appears that: —

1) During an observation period of 2 weeks the formative power of the climatic conditions as a whole is found to be the same both for the the growth of the stalk and for the increase of leaf product The former

TABLE II. — *Average hourly growth in hundredths of a millimetre.*

Degrees Centigrade	Length of exposure in hours												
	3	6	9	12	15	18	21	24	27	30	33	36	39
12	15	9	9	9									
13	14	10	10	10	11	—	—	13(23)	13(28)	13(31)	—	14(35)	—
14	20	15	16	16	17	—	—	19(23)	19	19	21	21	—
15	21	17	19	20	22	—	—	26(25)	27(28)	28(31)	28(34)	—	—
18	18	23	26	28	—	—	—	—	—	—	—	—	—
20	32	36	41	45	48	—	—	—	—	—	—	—	—
21	37	44	48	53	—	—	—	—	—	—	—	—	—
22	37	39	51	59	—	—	—	—	—	—	—	—	—
23	44	52	59	64	—	—	—	—	—	—	—	—	—
24	50	58	64	69	—	—	—	—	—	—	—	—	—
25	60	66	70	75	—	—	—	—	—	—	—	—	—
26	58	65	75	82	—	—	—	—	—	—	—	—	—
27	70	78	83	90	—	—	—	—	—	—	—	—	—
28	72	80	89	98	—	—	—	—	—	—	—	—	—
29	88	89	94	105	—	—	—	—	—	—	—	—	—
30	77	94	100	108	—	—	—	—	—	—	—	—	—
31	69	93	100	100	116	117	121	123	126	130	131	133	133
32	72	92	101	111	116	120	123	125	127	128	129	130	128
33	68	83	94	101	107	110	113	—	—	—	—	—	—
34	59	76	89	97	100	103	106	—	—	—	—	—	—
35	56	74	84	86	89	92	92	—	—	—	—	—	—
36	47	65	72	74	76	76	73	71	—	—	—	—	—
37	55	65	69	70	72	70	68	—	—	—	—	—	—
38	31	46	55	58	57	56	53	47	—	—	—	—	—
39	31	41	47	46	46	45	43	—	—	—	—	—	—
40	27	34	34	31	30	28	26	—	—	—	—	—	—
41	19	25	23	20	18	14	(12)	—	—	—	—	—	—
42	9	13	12	11	10	9	(8)	—	—	—	—	—	—
43	12	9	7	6	5	(1)	—	—	—	—	—	—	—

value passes from a minimum of 79 at Monrovia to a maximum of 125 at Baltimore. According to that measure it may be said that the average intensity of the climatic conditions as a whole at Monrovia is equal to 63 % of that at Baltimore

2) In an observation period of 4 weeks the data obtained are much more uncertain and less defined just as if the plant, considered as an instrument, was exhausted from too long exposure. The length of the observation period is therefore a factor of capital importance, of which the optimum value must be recorded with the greatest possible accuracy

The efficacy of the climatic conditions as a whole, that is to say the power of producing growth of the typical plant chosen for the purpose may be considered as a product of 2 factors viz., intensity and duration. For the former the average of 5 biometric values dealt with in Table IV,

TABLE III. — " *Thermo-physiological indices* " *of plant growth based on data established by* LEHENBAUER *by exposing young maize plants to various temperatures during a period of* 12 *hours* (see Table II).

Centigrade Scale		Fahrenheit Scale			
Degrees	Indices	Degrees	Indices	Degrees	Indices
3	0.333	36	0.111	81	103.000
4	0.667	37	0.222	82	106.889
4.5	1.000	38	0.342	83	110.778
5	1.333	39	0.667	84	115.000
6	1.889	40	1.000	85	118.111
7	2.778	41	1.333	86	120.000
8	3.667	42	1.667	87	121.222
9	4.889	43	2.000	88	122.000
10	6.333	44	2.344	89	122.333
11	8.000	45	3.000	90	121.667
12	9.889	46	3.500	91	117.667
13	12.111	47	4.000	92	113.444
14	14.778	48	4.778	93	108.333
15	17.778	49	5.500	94	103.333
16	21.556	50	6.333	95	96.000
17	26.000	51	7.111	96	91.444
18	31.333	52	8.167	97	85.000
19	38.000	53	9.222	98	79.444
20	46.000	54	10.333	99	73.111
21	54.778	55	11.667	100	66.667
22	63.444	56	12.778	101	60.000
23	71.111	57	14.444	102	52.667
24	79.111	58	16.111	103	44.444
25	86.556	59	17.778	104	36.000
26	94.000	60	19.883	105	28.667
27	101.222	61	22.000	106	21.889
28	108.444	62	24.333	107	16.778
29	115.778	63	27.111	108	12.556
30	120.000	64	30.000	109	9.444
31	121.889	65	33.333	110	7.000
32	122.333	66	37.222	111	5.222
33	116.111	67	41.333	112	3.778
34	107.333	68	46.000	113	2.778
35	96.000	69	50.833	114	2.000
36	86.556	70	56.000	115	1.444
37	75.667	71	60.333	116	1.000
38	64.333	72	65.333	117	0.500
39	50.667	73	69.000	118	0.111
40	36.000	74	73.667		
41	23.333	75	78.111		
42	14.000	76	82.333		
43	8.333	77	86.556		
44	4.889	78	90.667		
45	2.778	79	95.000		
46	1.667	80	98.667		
47	0.667				

is taken, and for the latter the average duration of the growing season at each station.

TABLE IV. — *Relative daily averages for each station. (The letter* H *indicates high values,* M *intermediate value and* L *low values.)*

Stations	Number of Days	Duration: 2 weeks — Height of stalk		Duration: 2 weeks — Leaf product		Duration: 4 weeks — Height of stalk		Duration: 4 weeks — leaf area		Duration: 4 weeks — dry weight	
Oakland.	125	L	86	L	77	L	71	L	71	L	79
Chewsville	154	L	87	L	84	L	75	L	74	L	78
Monrovia	154	L	79	L	80	L	66	L	71	L	79
College	154	M	95	M	101	M	80	M	110	M	119
Baltimore	153	H	125	H	119	M	104	M	115	M	105
Carlington	154	H	113	H	118	H	106	H	148	H	144
Doleman.	168	M	96	M	107	M	80	M	117	M	113
Easton.	171	M	95	M	105	M	75	L	82	L	83
Princess Anna . . .	169	M	106	M	96	M	92	M	117	M	116

TABLE V. — *Relative climatic efficacy at each station.*

Stations	Average normal duration of the growing season (A)	Relative general averages of the average daily intensities of growth for the whole period of observation (B)	Product of Climatic efficacy (A × B)
Oakland.	117	77	9 009
Chewsville	156	80	12 480
Monrovia		75	—
College.	167	101	16 867
Baltimore	223	114	25 422
Darlington	188	126	23 688
Coleman . . .	205	103	21 115
Easton. . . .	201		17 688
Princess Anna	181	105	19 005

These products of climatic efficacy represent more or less approximately the relative values of climatic conditions (of the different stations), so far as they influence plant growth, and furnish points of reference for the comparative quantitative study of climatic conditions as a whole.

One of the objects of ecological climatology is precisely that of valuing climates, like hydraulic force, mineral deposits and other sources of riches which have a well-defined geographical distribution.

The importance of these researches is considerable, both for agriculture and for sylviculture, and the results obtained by the author constitute a new step towards the solution of this important problem.

790 - **Effect of An Extraordinarily Hot April on the Progress of Phenological Phenomena in East Prussia, in 1918.** — KNÖRZER, A., in the *Phaenologische Mitteilungen* 1919, year, 37, No. 26, pp 26-30. Darmstadt, 1920

Normally the mean April temperature becomes lower in proceeding further from the south-west towards the north-east, so much so that between the extreme north west corner of Prussia and the hottest zones of Rhineland there is a difference of 5.5°C. The following data give an idea the distribution of April temperatures in different sectors of Central Europe, — Lugano 11.4°4C.; Bozen-Gries, 12.7; Montreux, 9.6; Colmar, 10.6°; Heidelberg, 10.0°; Berlin, 7.7°; Bromberg, 6.9°; Königsberg, 5.4°; Marggrabowa, 5,0°; Memel 4.8°C.

In 1918, on the other hand, there was an exceptional April and the distribution of the temperatures is almost the inverse of the one preceeding — Lugano, 9.4°, Bozen Gries, 11 2°; Montreux, 8.7°; Colmar, 10.9°; Heidelberg, 10.4°; Berlin, 11.4°; Bromberg, 12.1°; Königsberg, 12.2°; Marggrabowa, 11.0°; Memel 11.0°C There are the following differences from the means: Lugano — 2,0°; Bozien-Gries, — 1,5°; Monticux, — 0,90°; Colmar, + 0.3°; — Heidelberg, + 0.4°; Berlin, + 3.7°; Bromberg + 5.2°; Königsberg + 6.8°; Marggrabowa + 6°0.; Memel + 6.2°C.

Such high positive differences had never been recorded in Prussia; at Königsberg and Memel the temperature reached a maximum of 9.8° and 9.2° C. respectively.

TABLE I. — *beginning of the flowering season in East Prussia in the spring of* 1918.

	Botanical Garden of Konigsberg	Pillau	Allenstein	Losgehnen (Fredland)	Sensbrag	Johannisburg	Gerwiscken (near Gumbinnen)
Prunus spinosa . . .	April 21	April 20	—	April 21	April 21	—	—
» *avium*	» 21	—	April 20	—	» 21	—	April 23
» *Cerasus* . .	» 22	» 26	» 22	» 24	» 25	April 22	» 24
» *Padus*	» 22	» 22	» 22	» 22	» 26	» 21	—
Pyrus communis . . .	» 22	» 24	» 22	» 25	» 25	» 22	—
» *Malus* . . .	» 24	» 26	» 25	» 27	May 4	May 1	May 13
Aesculus Hippocastanus	» 26	» 28	» 28	» 25	—	April 30	—
Syringa vulgaris . . .	» 27	» 29	» 29	May 1	—	May 11	May 14

The extraordinarily high temperatures in April helped to accelerate considerably the revival of spring growth. Table I reproduces the data of the flowering season for certain trees in different parts of East Prussia.

Striking the general average of the given phenomena, and considering it as data for the begining of spring, April 21 is indicated for East Prussia in 1918.

Normally, according to IHNE, for various places in the region under consideration, the dates are: –

Födersdorf	17	May	Ibenhorst	22	May	Arys	19	May
Königsberg	17	»	Dingken	21	»	Grabnik	19	»
Fritzen	24	»	Brödlauken	17	»	Kurwien	23	»
Neustemberg	18	»	Sadlowo	18	»			
Pfeil	16	»	Rothebude	19	»			

The general average for East Prussia is May 19. In 1918 it was, therefore, more than 3 weeks in advance.

791 – **Effect of Late Spring Frosts on the Vine.** — NÉGRIER, A., in the *Revue de Viticulture*, Year 28, No. 1400, pp. 315-326. Paris, Apr. 1921.

The effect of late spring frosts is shown in various ways, and the following cases may occur: —

1) The buds may be frozen before they open.

2) The young shoots may be frozen.

3) The clusters may be destroyed without injury to the branches.

4) The ends of the branches may be affected while the clusters are unharmed.

5) Branches that are already strong and partially lignified at the base may be frozen up to just below the clusters.

In the first four cases cutting back is quite useless. In the fifth case on the contrary it is recommended to cut the branch at 2.5 cm. from the base, 3 or 4 days after the frost

The author does not recommend pruning the shoot back to the false bud (called " bourrillon ") of the previous year, because of the loss of sap which would result and because of the great development of adventitious branches which would ensue.

792 – **Effect of Late Spring Frosts on the Geographical Distribution of Forest Trees.** – RUBNER, in the *Forstwissenschaftliches Centralblatt*, Year 42, Part 2, pp. 41-49 and Part 3, pp. 100-114, Bibliography of 32 publications. Berlin, 1921.

The annual temperature and its distribution during the growing period, the rainfall and its distribution in each season, the hours of sunshine, the frequency of winds, are phenomena which are modified according to altitude and latitude, but in a gradual and steady manner,. Sharp limits of the area of distribution of a given forest species cannot therefore be constituted In considering the meteorological phenomenon of spring frosts, the question presents itself quite differently. When these frosts take place only occasionally, wood already formed (especially in young trees) although more or less damaged by them, easily survives the crisis; but when frosts are frequent and regular every year, their action must be felt from a geographical standpoint, in relation to the species which resist and those which do not resist cold.

This resistance depends on many factors.

PERIOD OF GROWTH: — Species which come into leaf late such as the oak and ash, are much less exposed to the retarding effect of frosts than early species, such as the beech

Quercus pedunculata var. *tardissima* is a good example of this order of phenomenon. In the district of Agram, at altitudes of 100 to 150 mm. it forms pure stands, whilst at higher altitudes mixed stands of the common *Q. pedunculata* and *Q. racemosa* appear This distribution is in relation with the last spring frosts. *Q. p.* var *tardissima* grows in damp places, most exposed to frosts, from which it saves itself owing to its late production of leaves whereas the two other oaks, which begin to shoot in the second half of April, would be inevitably damaged. They appear at higher altitudes and in drier and more open places, where the intensity and frequency of late frosts are very much reduced.

The mean dates of foliation are as follows:—

Quercus racemosa:— April 15-18.
Q. pedunculata:— April 25-30
Q pedunculata var. *tardissima*: — May 23-28.

The retarding effect of frosts, in so far as it affects the geographical distribution is exerted most evidently on the inflorescences, at the flowering stage, and on the newly-formed tissues. Silver fir, beech, and oak exposed to frosts do not always manage to produce their seeds regularly, whilst on the other hand, young plants are always liable to be frozen until they have reached a height of 1 to 2 metres.

CAPACITY FOR RECOVERY. — The alder, ash and, oak stand first, especially the last named owing to its foliation called after St John, as new buds make their appearance to replace those which might eventually have been destroyed by frost. The beech, however, is less apt to recover and conifers still less.

RATE OF GROWTH DURING THE FIRST STAGES OF GROWTH. — The shorter the duration of these stages, when the trees are most sensitive, the less is the probability of damage caused by frost.

Among deciduous trees, the alders, oak and ash are distinguished by their rate of growth, while the beech is much slower; among conifers the larch and Scots pine grow rapidly in the earlier stages, while the silver fir and *Pinus Cembra* grow slowly.

WEIGHT AND MOBILITY OF SEEDS. — In places subject to frost, heavy seeds do best; when ripe they fall in the immediate neighbourhood of the tree in the middle of the wood, so that young trees grow up under the shelter of full grown trees.

The relationship existing between frosts on the one hand and topographical conditions, on the other, the depth of snow, the date of the melting of the snows, and that of the last frosts, are explained by the author by means of the average data of foliation for the beech, oak and silver fir. A period without snow before the last frosts, constitutes a danger, the consequences of which increase as the period is prolonged.

[792]

Data concerning certain regions of Central Europe.

Regions	Altitudes in metres	Depth of snow in cm.		Average date of the last fall of snow	Average date of last frost	No of days without snow before the last frost	Average date of foliation (I - XII) (= January to December)		
		April	May				Beech	Oak	Silver fir.
Rhine and Palatinate	Up to 200	0.3	—	24 II	14 IV	49	23 IV	2 V	6 V
	200–400	1.0	—	5 III	5 V	31	—	—	—
Black Forest and Jura	Up to 200	—	1.0	11 III	14 IV	34	20 IV	29 IV	11 V
	200–400	2.3	1.3	14 III	28 IV	45	27 IV	3 V	11 V
	400–660	4.9	3.1	30 III	5 V	35	29 IV	7 V	16 V
	600–800	12.5	1.9	6 IV	12 V	36	5 V	13 V	20 V
	800–1000	17.1	3.9	18 IV	19 V	31	5 V	—	25 V
	1000–1220	25.0	4.3	25 IV	After	—	—	—	—
	1265	79.3	22.1	12 V	19 V	—	—	—	—
Mountainous zone of Central Germany	200–400	3.9	0.6	20 III	28 V	39	27 IV	8 V	21 V
	400–600	5.3	5.9	8 IV	12 V	34	1 V	6 V	14 V
	600–800	9.6	12.3	21 IV	19 V	28	11 V	—	17 V
	800–1000	28.3	7.9	2 V	After 19 V	—	—	—	—
Alps and Prealps	200–400	5.9	—	12 III	21 IV	40	29 IV	14 V	—
	400–600	7.3	2.2	8 IV	28 IV	20	4 V	14 V	—
	600–800	11.1	4.8	21 IV	12 V	21	5 V	—	22 V
	800–1000	14.2	10.9	2 V	19 V	17	—	—	—
	1600	47.7	36.4	27 V	After 19 V	—	—	—	—

Some German forest species, such as the silver fir and mountain maple, do not grow outside the mountainous region of Central Germany, and the limit is at approximately the same latitude both in Poland, and Prussia The eastern limit of copper beech is bounded by the line Königsberg — Allenstein — Kalische, that of *Quercus racemosa* by the line Königsberg — Ossoweicz — Brest-Litowsk, whilst *Quercus pedunculata* reaches, in latitude, as far as southern Finland, and to the east as far as the Ural mountains. How are the late spring frosts distributed in these districts ?

For Germany the author comments on the data, collected during 15 meterological forest seasons, and shows that the date of the last frost is not so much in direct relation with the altitude, as with the general conditions of the climate, the character of which becomes more rigorous and continental further to the east. Towards the first fortnight in May the plains of Russia are generally swept by a succession of cold waves, which are even felt in the eastern parts of Germany. Thus at the station of Kurrvien (East Prussia) the last spring frost happened, on the average, on June, 18, whereas at Melkerei in the high Vosges, at 934 m. altitude, the last frost took place on May 22. The geographical distribution of the beech is intimately allied with the distribution in frequency and intensity of spring frosts, and as these increase towards the east, the northern limit of the beech traces a curve towards the east.

The species which withstand cold best are the Swedish *Pinus sylvestris* the birch and the mountain alder, which can form forests up to 69-70° north latitude Of the two species of birch, *Betula pubescens* and *B. verrucosa*, the former reaches higher latitudes than the latter, probably because of its greater resistance to frosts, as may be deduced from the fact that this species flourishes also on peaty soils, more exposed to the action of frost. It might be thought that these species, which are capable of growing in the extreme north, could also grow at very high altitudes. This is not the case; as a matter of fact: —

The Scots pine reaches 1600 metres in the Bavarian Alps, and only in small stands; it reaches 1000 m. in the Black Forest, and only 800 m. in the Giant mountains.

Betula alba reaches 1400 m. in the Alps, 1028 in the Bavarian Alps, and only 500 m. in Central Germany.

The mountain alder reaches 1400 m. in the Bavarian Alps and 650 m. in Saxony.

On the other hand, the beech and silver fir, of which the former does not grow further north than Southern Sweden, and the latter beyond the mountainous zone of Central Europe, reach respectively, 1420 and 1500 m in the Bavarian Alps, 1200 and 1300 m. in the Black Forests, and 750 m. in Thuringia

The author suggests the following reasons for this phenomenon: — Pine, alder, birch, which are light demanding trees struggling with beech and silver fir, which are shade enduring species, endowed with greater growth and longer lives, are completely overcome, surrounded and choked by the last two which hinder their normal growth Moreover the Scots pine owing to the brittleness of its branches, is badly suited for the mountains, where the heavy snowfall increases the risk of broken branches. The author thinks that other similar facts can be explained in the same way. thus, the hornbeam (*Carpinus betulus*) extends much further north and east than the copper beech which, however, grows, to a higher altitude.

The importance of frosts as regards the distribution of forest trees has not yet been appreciated at its true value. Some writers attribute to rainfall a dominant effect on the geographical distribution of the silver fir; the author refutes this statement, and adduces numerous data, which make the effect of frost conspicuous Spring frosts should therefore be included among the most effective phenomena which determine the area and limit of the distribution of numerous forest trees.

793 – On the Lateritic Nature of Italian Soils and Researches on the River Silts. —

DE DOMINICIS, A., (Laboratorio di chimica agraria della R Scuola Superiore d'Agricoltura, Portici), in the *Annali della Regia Scuola Superiore di Agricoltura in Portici*, Sect II, Vol XV, pp 23, Portici, 1920

VAN BEMMELEN's method consists in the separation of decomposed silicates, insoluble in mineral acids, decomposed silicates of kaolinic nature, soluble in sulphuric acid, and decomposed silicates, soluble in hydrochloric acid, when in the last named the ratio $\frac{\text{molecules Si O}_2}{\text{1 molecule Al}_2\text{O}_3}$ is greater than 3, the soil colloids are composed of true agricultural clay; on the contrary, if this ratio is less than 3 it is laterite or gelohydrate of aluminium which prevails. By means of this method or suitable modifications of it, lateritic soils were identified in localities of southern and central Italy such as the provinces of Lecce, Foggia, Bari, Potenza, Naples, Caserta, and Teramo, as well as the arid zones of Tripolitania. These researches are so interesting that the utility of extending them systematically to all soils of southern and central Italy is indisputable. With this object, it is clearly, useful to examine river silts, of which the general diagnostic value enables entire regions, drained by the water carrying the earthy particles, to be included in a single survey. The finest compounds of a colloidal order, the chemical nature of which, disclosed by VAN BEMMELEN'S method, may serve as a guide for a more detailed examination in the drainage area of the river found largely in deltas. If the ratio is lateritic it would be possible to deduce that the clay nature does not predominate in the soils which constitute the entire basin. With this object the collection of silt from the rivers and streams of Italy has been undertaken and this work should be completed as soon as possible. The samples examined belong to the following rivers:— Tagliamento, Po, Foglia, Cecina, Tiber, Ofanto, Cozzelli, Belice. Physical and chemical analyses have been made of them, using SCHLOESING'S method for sandy matter, colloidal matter, calcareous matter, humus, hygroscopic moisture, and for the analysis of silicates VAN BEMMELEN'S method.

To sum up, whilt the investigation of lateritic soils is especially important in dry climates, because of their behaviour in the presence of water, with reference to the lack or bad distribution of rainfall, and the fertility of these same soils, in such dry climates the products which are derived from the process of laterisation all remain *in situ* without dissolving. It is therefore difficult in a chemical analysis, to separate and identify them; they are more easily separated by means of the artificial operation of levigation; this occurs naturally under the action of running water in the streams, and the examination of muds is interesting because it can serve as an indication of the nature of the soil of entire regions. The results obtained up to the present in this direction represent an experimental contribution to theories relating to the lateritic nature of the soil of Southern Italy, and give an entirely new direction to study and technique.

794 – **Physico-Chemical Investigation on the Power of Absorption of Soils and on the Way in which Plants Absorb Nutritive Matter in the Soil.** — CASALE, L. (Lecce, Scuola Agraria), in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. LIV, Parts 1, 2, 3, pp. 65-113. Modena, 1921.

Theoretical and experimental contribution to the study of the phenomenon which governs the power of absorption in the soil and absorption by plants; this phenomenon would take place both in the soil and in the plant independently of vital action which only intervenes to regulate and control it according to the requirements of the protoplasm.

The author recapitulates the data concerning the colloids and electrolytes of the soil and, in view of the importance of the ionic velocity in the phenomena of absorption, he sums up as follows the principal factor which may cause it to vary: —

1) The velocity of the ions decreases with an increase in the viscosity of the solvent. The nature of the salts in solution or the suspended colloidal matter has an influence on the viscosity of the solvent in the sense that the more abundant the suspended colloidal matter and the smaller the colloidal granules, the greater will be the viscosity.

2) The velocity of the ions increases with the temperature and tends to become the same for all the ions. The velocity increases with the temperature either because the viscosity of the solvent decreases with the temperature, or because the mass of the ion decreases with the temperature. It should be noted that the mass of the ion does not mean the atom or group of atoms which constitute it, but the ion and the molecules of the solvent which surrounds it to form the hydrate. These hydrates are unstable and become less complex with an increase in the temperature. With an increase in temperature, the mass of the ion becomes less and can move more easily in the solvent.

3) With great dilution, the hydrate formed by the ions is more complex and its velocity decreases sensibly. The effect of the temperature in increasing the velocity of the ions is more marked with great dilution, because the complexity of the hydrate formed by the ions undergoes greater variation.

4) All ions have not the same hydrating power. It may be stated that, in general, calcium and magnesium have greater hydrating power than ammonium, potassium, and sodium. The ion with the greatest hydrating power undergoes the most marked variation of velocity for an equal increase of temperatures.

5) Pressure also acts by increasing the velocity of the ions. From various experiments made with this object, from consideration of the data of other writers (PETERS, BRETSCHNEIDER, PRATOLONGO, WAY, ULPIANI, BERNARDINI) and their theoretical discussion, the author passes to the principal conclusion: — The causes which determine, the power of absorption of soils are the same as those which regulate the phenomena of absorption by the colloids.

The colloidal constituents of the soil receive a positive or negative charge according as they give out to the liquids which moisten them, anions or cations. Their charge will therefore be proportionately greater when the number of ions given out is greater. As the simultaneous presence of negative and positive colloids in a colloidal solution is inconceivable, it must be admitted that the positive colloids are absorbed, in the ground, by the mass of negative colloids. Each granule of negative colloid exercising an attraction on the ions charged with electricity of the opposite sign, determines around it the formation of a zone of concentration of cations. The absorption of the cations by the granule of the colloid takes place when the necessary difference of potential is established between it and the zone of concentration. The greater the number of cations present in the zone of concentration the more easily is that difference of potential reached.

It follows therefore that the degree of absorption and coagulation of a given electrolyte is highest when its ionic concentration is greatest. Different electrolytes have not the same coagulating power; but this, all other conditions being equal, is highest when the tension of solution of the cation of the electrolyte is lowest and when its relative velocity is greatest. Iron and aluminium have greater coagulating power; next in decreasing order come magnesium, calcium, potassium, ammonium, and sodium. Sodium is an exception to the rule, inasmuch as it unites a high tension of solution with a low relative velocity and because its salts are feebly dissociated.

It is not only the cationic nature of the added electrolyte which influences the coagulating power and the quantity of cation absorbed by a given quantity of soil, but also the anion, in the sense that while the coagulating power increases with the relative velocity of the anion, the quantity of cation absorbed decreases. Absorption by the colloids is not effected on each cation but on the whole of the zone of their concentration. Hence the anions which, existing in the zone of concentration, give rise to insoluble compounds on the colloidal membrane, are able to remain fixed.

The complex soil solutions give up a greater quantity of the swiftest cations. For this reason potassium and ammonium are most absorbed, followed by calcium, magnesium, and sodium.

The different cations are retained on the colloidal granule by electric action and are deposited on its membrane in order of arrival, so that the last to be neutralised form the outer layers. The most-easily soluble ions form the outside layer of the colloidal membrane, and this is why they are more easily replaced by other bases. However the phenomenon of substitution is not due to a chemical action of double decompositon, as has been maintained by WAY since 1850 and confirmed by more modern chemists, but it also is due to electric action.

The difference of potential between the granule of the colloid and the solution which moistens it, is the factor which governs the phenomenon of absorption and substitution. All factors which may cause variation in the difference of potential and the surface tension, help to cause variation in the composition of the products of absorption.

To cause the production of the phenomenon of absorption it is necessary that the colloid should receive a negative charge and send positive ions into solution. Thus basic silicates and humates, treated with boiling hydrochloric acid and freed from the substances formed by continual washings, lose their power of absorption, because they cannot drive the cations in solutions.

The behaviour of the organic colloids may be summed up as follows: — 1) They have a smaller negative charge than that of inorganic colloids; 2) to coagulate them, considerably greater quantities of electrolytes are required than in the case of inorganic colloids; — 3) they act as protectors to the coagulation of inorganic colloids so long as the latter have a concentration below a certain limit; beyond that limit they on the contrary, facilitate coagulation; 4) they absorb both the cation and the anion of the salt which determines their coagulation; 5) they behave in an absolutely identical way to inorganic colloids when they are treated with metallic salts at a lower tension of solution than hydrogen.

Regarding the manner in which the plant absorbs the nutrients in the soil, the author, after having recalled the opposite points of view of EHRENBERG and ROHLAND and the opinion of ULPIANI, describes some of his expements and considers the mechanism of absorption, to which he applies considerations relating to the action of manures with special regard to the views of the American school of WHITNEY and his followers. Finally, comparing these considerations with the conclusions mentioned above on the subject of the power of absorption of soils, the author sums up the manner in which plants absorb the nutritious substances in the soil as follows:— The ectoplasm of the absorbing cells forcing the hydrogen ions into solution acquires a negative charge. This charge is less than that of the soil colloids so that there is a difference of potential between the plant and the soil. By virtue of this difference of potential the granules of the colloid are attracted by the absorbing zone to which they adhere tightly. The colloids of the soil tend to equalise their negative charge with that of the ectoplasm and drive the cations towards the latter. A kind of continuity is thus established between the plant and the soil colloids. The nearest colloids give up ions to the plant, those further off to those which are nearer. The passage of ions from one granule to another would go on until the charges of the ectoplasm and the colloids of the soil are equalised; but this equality is unattainable, since the ions absorbed by the ectoplasm do not remain on it; but, by an identical act, they are attraced by the tonoplasm. They must therefore pass through the protosplasmic mass and can thus be utilised.

Absorption by the absorptive cells is effected in the same way as with the colloids, that is to say, it does not take place for each cation, but for a whole zone of concentration which is formed round the cell. In that zone there are also anions which can be utilised in passing through the protoplasm.

The phenomenon of absorption commences with a demand for moisture on the part of the plant, which according to its requirements and by the help of the production of substances with osmotic activity regulates the circulation of moisture. The moisture demanded by the interior of the plant brings to a higher degree of saline concentration the liquid layer nearest to the absorbing zone and thus facilitates absorption. Cultures made in nutrient solutions acquire an acid reaction due to the hydrogen ions driven into solution by the ectoplasm. The hydrogen ions, which, are at a low tension of solution, hinder absorption. Cultures made in nutrient solutions containing colloids, on the contrary, have not an acid reaction because the hydrogen ion is absorbed by the colloids, and they can, consequently support greater dilution than simple nutrient solutions. Absortion also proceeds more regularly, because the granules of the colloids can absorb the cations not used by the plant instead of those given up to the plant.

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In the soil, absorption is more intense when the difference of potential between the plant and the colloids of the soil is greater. The latter offers the plant substances absorbed by the solutions which are the same as those required by the plant. The plant thus profits by the substances which it needs, while the colloid profits by the elements which the plant rejects. If these elements are already abundant in the soil the plant must use them.

The exchange of nutritive substances between one cell and another, determined by a need of the protoplasm, is governed by the same factors as those which determine absorption. The moisture, circulating in the plant, permits and helps the circulation of nutritive substances.

The beneficial action of fertilisers is explained by the influence exerted by their cation in lowering the negative charge of the colloids, which increases the difference of potential between them and the plant Fertilisers are therefore not so useful on account of the need of the plant for their constituents as on account of the influence which they exert in increasing the difference of potential between the plant and the soil.

The author himself remarks that the experimental work is not yet complete and he proposes to renew the investigation with this object in view.

795 - **Mechanism of Flocculation in Soils.** — A Contribution to a General Discussion on "Physico-Chemical Problems Relating to the Soil," held by the Faraday Society on Tuesday, May, 31, 1921, in *The Chemical News*, Vol. XXII, No. 3192, pp. 279-281. London, June 17, 1921.

The structure of the soil, so far as the mineral part is concerned, is determined by two principal factors: — The dimensions of the soil particles and their arrangement.

In practice the dimensions of soil particles, evidently remain permanent and unaltered; these dimensions are measured conventionally, in England, with reference to particles which pass through a 3 mm. sieve, as follows:—

	Diameter in mm.
1. Stones and gravel	3.00 - 1.00
2. Coarse sand	1.00 - 0.20
3. Fine sand	0.20 - 0.04
4. Silt	0.04 - 0.01
5. Fine mud	0.01 - 0.002
6. Clay	less than 0.002

The finest particles are separated by levigation, the coarsest by sifting.

On the other hand the arrangement of the soil particles is by no means permanent; and is even subject to rapid changes. Besides modifications caused by mechanical actions, there is the phenomenon of aggregation of the finest particles, which renders the soil more friable.

The phenomenon of flocculation is influenced by several factors such as freezing, thawing, insolation and the presence of electrolytes; the phenomenon is reversible, for deflocculation is produced as soon as the factor which produced the flocculation disappears, and the author considers precisely the process of floculation, due to electrolytes in general and to lime in particular.

Custom has fully confirmed the effect of certain fertilisers on the structure of the soil; thus the prolonged use of nitrate of soda induces an increased tenacity in the soil; it deflocculates clay so much as to cause it to be carried away in considerable quantities by drainage water. However, the most remarkable and important fact in practical agriculture is that of the improvement of the structure of the soil produced by liming; the experience of numerous generations has confirmed that liming, in the proportion of 1 to 2 tons per acre, greatly reduces the tenacity of clay soil and makes it easier to plough and drain. However, variations may be found and this comes from the fact that clay is easily flocculated by lime whereas silt is not.

The flocculation of the soil particles seems to correspond only to the flocculation of suspensoids, which is based on the theory of the isoelectric point, there is, therefore, *grosso modo* a norm between the flocculation power of electrolytes and the valency.

The flocculation of clay by lime is a most important exception, because it does not agree with the electric theory, if it was so, the hydroxyl ion would have stabilised the suspension To explain this anomaly the transformation in the soil of the lime into bicarbonate, and the action of the latter as flocculant, would have to be admitted but this explanation is not very plausible, and note should be taken of:—

1) The different effect on clay and on fine silt

2) If two similar suspensions of clay are treated with calcium hydrate and bicarbonate, in equivalent quantities, flocculation is much more rapid with the former, the contrary occurring with fine silt.

In studying the effect of alkalinity on flocculation by means of a calcium salt, in clay and fine silt suspensions it was found that the flocculation of clay by calcium nitrate is greatly intensified,even as regards the volume of coagulum, by the addition of a small quantity of ammonia, whereas the flocculation of fine silt is retarded by the alkaline addition; the anomaly of the flocculation of clay by means of lime, which is favoured by the hydroxyl ion, is thus confirmed.

To explain the mechanism of flocculation in the soil it is therefore necessary to take into account two important characters of clay.

1) It reacts easily, with exchange of bases, and of solubility in acids;

2) The clay particles do not present in water a well defined solid surface to the liquid, but colloidal and silicious matter passes.

On the basis therefore of power of reaction, and on the protection which clay enjoys, three cases of flocculation may occur:—

a) Direct flocculation, in which the flocculant acts as on non-reactive and unprotected particles, the action being even more or less retarded by the protection of the clay particle, but this case occurs but rarely and then only under the action of salts or colloidal hydrates of iron and aluminium.

(*b*) *Indirect flocculation*, where the products of a preliminary reaction such as exchange of bases or solution, act as flocculants ; there is no doubt that when using neutral salts, this kind of flocculation is brought about to a certain degree by the exchange of bases : flocculation of the clay by means of acids also appears to be due largely to the indirect action of aluminium in solution.

(*c*) *Abnormal flocculation*, in which the flocculant reacts with the emulsive protective matter, and forms a coagulum, which carries the particles with it ; this kind of flocculation of clay seems to be of the greatest agricultural importance because it gives a plausible explanation of the abnormal flocculation of clay due to lime.

To sum up ; although the mechanism of flocculation in soil does not appear to be fundamentally different from that of flocculation of suspensoids alone, the flocculation of clay by lime constitutes a process of a distinctly different type ; it is an emulsoid phenomenon which is due to the reaction between calcium hydrate and colloidal silica, on the one hand, and, on the other, to a special colloidal condition of clay, different from that of other fractions of the soil, and of kaolin itself.

796 - **Formation of Nitrate in the Cultivated Soils in Illinois, U. S. A.** — WHITING, A. L. (Chief in Soil Biology), and SCHOONOVER, W. R. (Associate in Soil Fertility), in the *University of Illinois, Agricultural Experiment Station Bulletin*, No. 125, pp. 1-63, Urbana, Ill. March, 1920.

The aptitude of a soil to produce a large amount of nitric nitrogen, sufficient to satisfy the requirements of growing crops, except for leguminous crops, and this in spite of washing by rain, constitutes one of the principal factors of a greater and more economic production of food, whence the importance of systematic study of nitrates in cultivated soils. A series of observations, which lasted a year, was undertaken with this object on expertimental plots at two farms of the Agricultural Station of Illinois. It was thus possible to measure systematically the percentage and rate of formation of the nitric nitrogen in the soil, up to a depth of 15 cm., in soils treated and cultivated in different ways, and it was possible to determine their influence as well as that of the season and rainfall.

The principal factor which favours the production of nitrates in the soil is the manner in which the soil is treated. Climatic factors govern the course of the formation of nitrates, but the quantity produced depends on the treatment of the soil; crude mineral phosphate is an important element for increasing the production of nitric nitrogen, and this effect is greater with good rotations of crops than if the latter are inadequate, but a complete application of organic matter (plant debris and farmyard manure) of phosphate and lime causes a greater and more rapid formation of nitrates than if organic matter and lime, or organic matter alone, are used. This application will satisfy the requirements of abundant crops, and, at the same time, dispense with the purchase of commercial nitrogenous fertilisers.

It is proved that the nitrogen of clover and of sweet trefoil, dug in during April and May, furnishes nitrates for the subsequent rotation crop, and although farmyard manure is equally efficient for nitrification, especially if it is applied with phosphate and lime, it does not nitrify to the same extent and with the same speed as the above mentioned leguminous plants. Active organic matter also greatly increases the provision of nitrogen in dark sandy silt soils. The best rotation for the formation of nitric nitrogen is that in which leguminous plants are used as green manure and where two crops, consuming large quantities of nitrogen are not planted in succession.

The maximum production of nitrates is noticed generally in June, with maize and soya beans and in May, with wheat and oats. The rate of formation of nitric nitrogen varies according to the season in the following manner: —

a) At the end of spring and beginning of summer, the period of greatest formation and accumulation; the optimum of temperature and humidity is found at this season;

b) at the beginning of autumn there is often a second period of activity in the production of nitrogen, which constitutes a second degree of optimum for nitrification;

c) at midsummer, small production of nitrates, unless the weather is cool and there is a sufficient amount of humidity;

d) in winter the formation of nitric nitrogen has never been recorded.

The most efficient cultural treatments which reduces the losses of nitrogen by lixiviation, is the presence of vegetable debris; a growing crop also decreases these losses.

The greatest consumption of nitric nitrogen, estimated by the corresponding dimunition of nitrogen in the soil coincides for maize with the period of greatest visible growth, which takes place generally between June 25 and July 15; for wheat and oats, the greatest consumption takes place earlier, towards the middle of May or the beginning of June, and, in the cases investigated, earlier with wheat. The period of greatest consumption of nitrates, as well as the rate and percentage of their production, are directly connected with the treatment of the soil; thus according to the author, plots suitably treated gave earlier and greater quantities of nitric nitrogen, than those not so well treated, and in the former the renewal of the formation of nitrates took place also earlier and more abundantly.

797 - **Chemical and Biological Researches on the Soil of a Wood of Hypertrophied Spruce trees' in Denmark.** — WEIS, F. and BONDORF, K A., in *Det Forstlige Forsgraesen i Danmark*, Vol V, No. IV, pp. 343-352, fig. 1, Copenhagen. 1920.

The chemical analyses of soil on which some hypertrophied spruce trees were growing showed that this soil was very rich in nitrogen both absolutely and relatively to the fertilising mineral matter. The reason for hypertrophy of the spruce trees should therefore doubtless be found in this lack of balance in the assimilable fertilising matter, causing an exclusively nitrogenous nutrition of the trees.

The nitrogen contained in the soil examined, under favourable conditions, easily assumed a nitric form, but the cause of this intense nitrification cannot be explained except by considering that it is produced in a very acid soil. That this is due to biological factors is proved by the fact that on sterilising the soil in question, nitrification ceases. In investigating the influence of different substances on this nitrification the remarkable fact has been noted that peptone hinders it and that sulphate of ammonia becomes nitrified very incompletely or not at all, unless calcareous matter is added.

The attempt made by the authors to isolate the forms of nitrifying bacteria were not successful; soil cultures in WINOGRADSKY's solution were always negative; it may be that the nitrifying bacteria are not the only active ones in very acid and humiferous forest soils (1).

798 – **Soil Protozoa.** — CRUMP, L. M., (Rothamsted Experimental Station), I. Numbers of Protozoa in certain Rothamsted Soils. *The Journal of Agricultural Science*, Vol. X, Part. 2, pp. 182-198, figs. 20, bibliography of 23 works Cambridge April, 1920. — II. CUTLER, D. W. (Rothamsted Experimental Station), A Method for Estimating the Number of Active Protozoa in the Soil. *Ibid.*, pp. 135-143, bibliography of 10 works. — III. CAUDA, A., and SANGIORGI, G (Istituto d'igiene della R. Università di Torino), Untersuchungen über die Microfauna der Brohen aus Reisgegenden, *Centralblatt fur Bakt.*, *etc.*, II. *Abt*, Vol 42, No 15-16, pp. 393-398, 6 figs Jena, Oct 30, 1914 — IV. CAUDA, A. La microfauna del suolo in rapporto alle colture, *Il Coltivatore*, Year LXVII, No. 12, pp. 357-359. Casale Monferrato, April 30, 1921 (2)

I. — Determination of amoebae and also, in certain case, of ciliates and flagellates in samples of soil taken from different fields at Rothamsted; the conclusions arrived at are that flagellates, amoebae, and thecamoebae are usually present in the soils in the trophic condition, that is to say feeding, and in comparatively large numbers so that here is an extensive population actively in search of food. The protozoan fauna is practically confined to the top 15 cm. of the soil. There is a definite inverse relation between the numbers of bacteria and amoebae present in the soil. The amoebae are insensible to variations in the moisture and temperature of the soil and to rainfall; the richer the soil in organic matter the more abundant are the protozoa, especially amoebae and thecamoebae.

II. — Up to the present most methods of determining protozoa in samples of soil give their total number, but what is required to be ascertained approximately is the number of those in an active condition and not encysted. With this object, the author proposes a fractional method of determination, by which the total number of protozoa is first ascertained by means of a dilution process; a fresh portion of soil is then treated with 2 % hydrochloric acid for a night; in this way all active forms are killed; the number of encysted protozoa is next ascertained by the dilution method and the number of active forms is ascertained by subtraction.

III and IV. — Investigations made on 6 types of soil from Vercelli (Novara) and Mortara (Pavia) show the constant presence of amoebae; the following are the numbers of different forms of protozoa per cubic centimetre of culture fluid (average of 4 dilutions of the 1/10 soil extract diluted in nutrient solution in the proportions $^1/_{100}$, $^1/_{1000}$, $^1/_{10000}$, $^1/_{100000}$. —

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(1) See *R.*, 1919, No. 173. (*Ed.*)

(2) See *R.*, 1913, Nos. 14, 167 and 646. (*Ed.*)

Soil	Amœbæ	Flagellates	Ciliates	Total
Clover.	370 000	120 000	16 000	506 000
" Marcita " (artificial meadow).	70 000	200 000	45 000	315 000
Irrigated meadow	150 000	37 000	absent	187 000
Submerged rice-field.	125 000	absent	»	125 000
Wheat after rice	17 000	»	»	17 000
Dry rice-field	10 000	»	»	10 000

Clover in rice-field soils grown twice in succession does badly and the clover fields soon show signs of exhaustion ; the " marcite " and irrigated meadows rich in organic matter have also a rich micro-fauna.

To prevent damage caused by a rapid increase of protozoa in the soil, the author recommends the application of potash salts, phosphates, calcareous compounds, as well as special tillage of the soil, special rotations of crops which serve to correct and modify the condition of exhausted soils, that is to say which tend to the " marcescenza, " in place of disinfection ; but the best results will be obtained by an intelligent change in the system of cultivation.

799 – **Production of Mineral Phosphate in the United States in** 1920. — I. *Engineering and Mining Journal*, No. 22, p. 908, New York, May 28, 1921. — II. *The American Fertilizer*, Vol. LVI, No 10, p. 54. Philadelphia, May 7, 1921.

According to data collected from all the producers at the commencement of April, 1921, by the United States Geological Survey the production of phosphates in the United States in 1920 greatly exceeded that of any previous year. The quantity mined and sold was 4 103 982 long tons, that is to say about 1 million tons more than in 1913 when the production was exceptional. The total sales amounted to $25 079 572 that is to say more than double those of any other year.

The average sale price of the whole output was £6.11 per long ton as againt $5.10 per long ton in 1919.

The production in Florida was more than doubled, the quantity of pebble extracted having increased by more than 1.5 million tons South Carolina produced 27% less than in 1919 ; Tennessee increased its production by 100 000 long tons, or 18 % and an increase of 223 % is reported in the production from Idaho and Utah. The production of the Western States of the Union (chiefly due to Idaho), amounting to 17 000 long tons in 1919 rose sharply to 55 000 long tons or more in 1920.

TABLE I. — *Mineral phosphates exported from the United States in* 1920.

	Quantity		Value
	Long tons	Metric tons	*Dollars*
High grade hard rock	344 896	349 610	4 496 457
Land pebble	693 355	704 481	5 593 814
Other classes.	31 761	32 271	500 904
Total . . .	**1 070 012**	**1 086 362**	**10 591 175**

The total exports in 1919 were 378 731 long tons valued at $3 567 982 Table II sums up the output of the industry during the last, 8 years:—

TABLE II. — *Mineral phosphates sold and exported from the United States during the period* 1913-1920.

Year	Quantity sold	Quantity exported	Proportion of exportation output
	Long tons	*Long tons*	
1913	3 111 221	1 366 508	44 %
1914	2 734 043	964 114	35
1915	1 835 667	253 421	14
1916	1 982 385	243 678	12
1917	2 584 287	166 358	6
1918	2 490 760	143 455	6
1919	2 271 983	378 731	17
1920	4 103 982	1070 012	26

TABLE III. — *Mineral phosphates mined and sold in the United States in* 1919 *and* 1920

	1919			1920		
	Quantity	Total value	Average value	Quantity	Total value	Average value
	Long tons	*Dollars*	*Dollars per long ton*	*Long tons*	*Dollars*	*Dollars per long ton*
Florida:						
Hard rock	285 467	2 452 563	8.59	400 249	4 525 191	11.31
Soft rock	14 498	196 318	13.54	13 953	190 551	13.66
Land pebble . . .	1 360 235	5 149 048	3.79	2 955 182	14 748 620	4.99
	1 660 200	7 797 929	4.70	3 369 384	19 464 362	5.78
South Carolina:						
Land rock	60 823	308 968	5.08	44 141	367 209	8.32
Tennessee.						
Brown rock (1) . .	475 475	3 123 565	6.57	556 177	4 425 761	7.96
Blue rock	58 550	290 951	4.97	78 671	518 234	6.59
	534 025	3 414 516	6.39	634 848	4 943 995	7.79
Western States (2) .	16 935	69 855	4.12	55 609	304 006	5.47
Totals and averages .	**2 271 983**	**11 591 268**	**5.10**	**4 103 982**	**25 079 572**	**6.11**

(1) Including the brown rock of Kentucky. — (2) 1919: Idaho, Utah and Wyoming; 1920: Idaho and Utah.

800 – **Phosphates of Nauru and Ocean Islands.** — STEEL T., in *Journal of the Society of Chemical Industry*, Vol. XL, No. 6, pp. 59,61 T. London, March 31, 1921.

Detailed analyses of the different kinds of phosphates from the island of Nauru and Ocean (1) are rare ; therefore the author gives in a Table, complete results of analyses of 16 samples of phosphates, 2 of which(Nos 6 and 16) are from the Ocean Island.

Some samples contained but traces of iron and alumina and a good many of them contained varying. but always small, quantities of fluorine. The appearance of the samples would suggest that it was a case of guano accumulated over the years Of the phosphoric acid, a part only was found in the form of tricalcium phosphate and the proportion of tetracalcic phosphate was variable, as in other natural phosphates.

801 – **The Physical Chemistry of Basic slag.** — DESCH, C. H, (Professor of Metallurgy in the University of Sheffield, (Transactions of the Faraday Society, Dec. 1920), in *The Chemical News*, Vol. 122, No 3177, pp. 102-103. London, March 11, 1921.

Complete physico-chemical knowledge of basic slag, is still lacking, in spite of the many excellent researches made regarding it. Chemical analysis has, indeed given the proportions of oxides of the metals and metalloids contained in it, and the sulphur content is also known, but there are many discrepancies regarding the nature of the phosphates and silicates and also, among the minor constituents, regarding that of the sulphides. The fact that perfect crystals have been isolated gives no assurance that they are identical with the ordinary constituents of the mass of the slag or that they are substances that are mineralogically homogeneus.

The essential constituents of basic slag are the oxides of iron, manganese, calcium, magnesium, silicon and phosphorus, whilst the sulphides of calcium and manganese and the fluoride of calcium should be considered as accessory; a state of oxidation only is considered although the iron may be found both in a ferric and ferrous state.

In basic slags containing more than 40 % of lime, the latter is found chiefly in the form of orthosilicate (Ca_2SiO_4) which may produce by excessive fusion, glass, in which are incorporated small crystals of phosphoric mineral; and this structure complicates the determination of the constitution or the slags. Regarding phosphorus, it should be remembered that anhydrous phosphates of iron (ferrous or ferric) that are stable at high temperatures are unknown on the contrary for calcium phosphates. Be that as it may, many writers have shown that the silico-phosphates are the principal constituents of phosphatic basic slags.

The first of these compounds has been described by CARNOT (1883; formula $Ca_3 (PO_4)_2 . Ca_2SiO_4$); STEAD and RISDALE next describes crystals of another compound containing phosphate and silicate (1887 ; formula $4 Ca_3 (PO_4)_2, Ca_3SiO_5$) ; other similar compounds were also described and in 1911, KROLL added to them another Thomasite ($Ca_3 (PO_4)_2$, 3 Ca.O

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(1) See INTERNATIONAL INSTITUTE OF AGRICULTURE, *Production et consommation des engrais chimiques dans le monde*, 2^{nd} edition, p. 12, Rome 1914. (*Ed.*)

Analysis of the Phosphates.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water at 200° C	1.75	1.62	1.70	1.28	0.93	1.18	2.92	3.50	4.88	4.23	0.70	1.83	1.60	0.27	0.30	1.05
Organic matter*	1.93	1.85	1.88	2.73	1.46	1.78	3.58	1.47	2.35	1.62	0.38	2.00	2.70	0.55	0.70	1.33
Sand	0.07	0.10	0.15	0.10	—	—	0.05	0.05	0.03	—	0.30	0.23	0.20	0.10	0.04	0.15
Lime (Cao)	55.20	55.10	54.80	53.10	55.80	55.20	54.80	54.80	52.80	53.20	56.40	54.40	54.70	33.90	34.80	41.70
Magnesia (Mgo) . . .	0.43	0.36	0.50	1.80	0.29	0.16	0.29	0.29	0.43	0.47	0.22	0.11	Trace	20.61	19.93	13.66
Sulphuric Anhydride (SO_3).	0.27	0.37	0.45	0.38	0.47	0.17	0.14	0.07	0.14	0.14	0.17	0.17	0.07	0.07	0.21	0.58
Phosphoric Oxide (P_2O_5) .	38.64	37.57	37.57	31.76	39.80	37.94	38.52	39.30	39.07	37.94	40.44	38.77	38.03	0.16	0.25	5.70
Carbon dioxide (CO_2) . .	1.99	2.77	2.77	8.05	1.12	1.67	0.67	1.00	0.95	2.48	0.65	1.80	1.38	45.30	44.75	37.10
	100.28	**99.74**	**99.82**	**99.20**	**99.87**	**9.810**	**100.97**	**101.48**	**100.65**	**100.08**	**99.26**	**99.31**	**98.68**	**100.96**	**100.98**	**101.27**
* Nitrogen	0.05	0.04	0.05	0.03	0.01	0.01	0.11	—	0.01	0.08	0.01	0.02	0.05	0.02	0.01	0.01
Ammonium by distillation with lime			0.0085				0.0085									

Ca_2SiO_4) Previously (1883) HILGENSTOCK had described the tetraphosphate (4 $CaO. P_2O_5$), which had long been considered as the essential component of agricultural slags, but it is no longer probable that the silicophosphates are most valuable for that purpose. Generally all the compounds are described externally, but little is known of their mineralogical individuality. It should be remembered that, as a rule, in these compounds calcium may be replaced more or less by iron or other metals, and that slags can be found with such an analysis that they will come under the formula of Thomasite It does not follow that these slags should be considered as individualised compounds, but rather as entectic mixtures simulating pure crystals; the fact that phosphorus can pass in solid solution in silicates of iron should not be overlooked. A micrograpic examination of the surface generally gives more information then the examination of sections, although the use of polarised light on the latter may be a good way to identify the minerals.

The sulphides enter into solid solution, but not to any extent; they remain partly in the form of insoluble globules. The fluorides are combined with phosphates to form minerals of the apatite class, which is the reason for the non-assimilability of fluoriferous slags.

This is about all that can be really definitely said regarding the constitution of basic slag and further research is absolutely necessary.

802 - **The Ash of the Green Husks of Almonds as an Industrial Product.** — DE DOMINICIS, A. (Laboratorio di chimica agraria della R. Scuola Sup. di Agricoltura, Portici), in *Annali della R Scuola Superiore di Agricoltura in Portici*, Sect II, Vol XV, pp 11. Portici, 1920

The production of almonds in Italy is developing greatly; among tree fruits it comes immediately after that of the citrus plants in point of yield, so that, for almonds also, Italy holds the first place, its average production for 1909-1916 being 1 564 000 quintals of almonds, that of Spain was less, 993 200 quintals, that of France and other countries was still less again.

A few years ago the whole value of almonds consisted almost entirely in the kernel; the shell, which burns easily was used for fuel; the green husk was used chiefly as green food for sheep who eat it greedily. It is only during the last few years, and especially in Sicily, that the industrial utilisation of the ash of the green husk of almonds has commenced. The ash is rich in potash and is sold to soap manufacturers.

As soon as the almonds are gathered, the green husks are separated from the rest of the fruit, and reduced to ashes in the fields in ovens made with circular stones ; when cold the ashes are ready for sale. A few years ago the price of the ashes was 8 to 12 lire per quintal, but after the commencement of the war it went up to 177 lire in 1916 and in 1920 it was more than 100 lire per quintal.

Analysis of the ash dried at 105° or 110° C gave the following results: —

	Per cent.		Per cent.
Sand and carbon	3.06	Phosphoric acid	3.15
Ferric oxide	2.03	Sulphuric anhydride	1.10
Lime	16.24	Carbonic dioxide	23.90
Magnesia	3.29	Silica	1.27
Potash	43.71	Chlorine	0.14
Soda	2.73		

The author has examined the green husks of 14 Sicilian varieties and has obtained the following extremes: -- Green husks % of almonds 25-55; water % of green husks 14.49-25.85; ash %, of dry green husks 7.35-12.80; potash % of ash 43.76-56.75; soda % of ash 2.04-8.27. The ash of the green husks is extraordinarily rich in potash, richer than any other vegetable ash. Their content in potassic carbonate can be estimated without fear of error at more than 70 % So that if the proportion of green husks of almonds is fixed at 40 % on average, for a production of 1 564 000 quintals of almonds per year, there are 625 600 quintals of green husks; taking the ash from the green husks in an undried condition, an average of 8.6 % of ashes may be calculated, which gives 53 801 quintals of ash with 37 660 quintals carbonate of potash.

There can therefore be no doubt of the much greater economic advantage of incinerating the green husks, than of using them as food for sheep; their use as a fertiliser is irrational, as the author has ascertained that the green husk decomposes with difficulty and very slowly; incineration on the other hand is an operation which, without expenditure on installation and fuel gives large quantities of potash, which the plant draws from the sub-soil with a minimum reduction in the reserves of the land cultivated.

The author has also analysed the shells of two varieties of Sicilian almonds: — Water % of shells 13.13-13.68; ash % of dry shells 0.45 0.58; potash% of ash 30.79-39.15; soda % of ash 2.25-5.34. The potash content of the ash of the shells is also high, and can be estimated at more than 50 % of potassium carbonate; the shells, however, are much less rich in ash; the residue which they leave compared with the moist substance, is only 0.45 %; so that calculating 1 251 200 quintal of shells out of 1 564 000 quintals of almonds there are 5630 quintals of ash with only 2815 quintals of carbonate of potash; it is therefore preferable to continue to use the almond shells as domestic fuel.

Regarding the destination of the ash of green husks of almonds, the idea of using them as a fertiliser should be abandoned because of their high alkalinity, their industrial use for the preparation of concentrated lyes, or for the extraction of carbonate of potash is best.

803 - **Halophytes as Potassic Manure** — See No. 809 of this *Review*.

804 - **On the Fertilising Action of Sulphur.** -- CHAUZIT, J. in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*. Vol. VII, No. 21, pp. 492-493. Paris, June 1, 1921.

After many years of experiment, the author thinks it possible to draw a certain number of conclusions with regard to the use of sulphur as a fertilising agent.

1) Sulphur distributed in cultivated soil has a very distinct action, shown by an increase of the crop, varying according to the greater or less quantity of organic matter existing in the soil, extent of surface in contact and the greater or less time of contact

2) The action is proportional to the quantity of sulphur used, a quantity which apparently should be fixed, economically and practically, between 400 and 600 kg. per hectare.

3) The sulphur should be applied as long as possible before the period during which the plants have an intense need of nutritive elements. In other words the sulphur should be applied in the autumn or the beginning of winter and with it should be dug in farmyard, or other organic, manures whereas, in the case of application early in the autumn (with farmyard manure) 200 kg. of sulphur per ha. gives good results, the quantity should be raised to 400 kg. when manuring is done in winter.

4) The effects noticed (increase of crop, more healthy plants, greater resistance to drought, decrease or disappearance of certain diseases), are due to the fact that sulphur sets free and renders assimilable the nutritive elements in the organic matter and certain mineral matters (potash) of the soil.

805 - **Botanical Identification of Exotic Spects of Phaseolus.** — THANH GIUNG, in the *Comptes rendus de l'Academie des Sciences*, Vol 172, No 13, pp 1436-1438. Paris, June 6, 1921

Those very small kidney beans, generally green, which botanists ordinarily group under the single general name of *Phaseolus Mungo*, are cultivated and eaten in various tropical countries. LINNAEUS, however, distinguished two species: — *Phaseolus Mungo* and *Phaseolus radiatus* Later ROXBURGH added a third species. *Phaseolus aureus*. But the very great resemblance in form and size shown by all these seeds have caused the three names to be considered as synonyms. Only more recently, in 1914, PIPER of the Department of Agriculture revising the genus *Phaseolus*, has re-established, besides the species *Ph. Mungo*, the species *Ph. aureus* Roxb., and he regards *Phaseolus radiatus* L. as the ancestor of *Ph. aureus*

It is nevertheless difficult to distinguish three kinds of seeds so close to each other when, especially in collections, they are not accompanied, as is generally the case, by other parts of the plant. Now in the course of a general investigation of the seed tegument of Leguminosae, the author noticed that the structure of these teguments differs considerably in various species, which enables the different species to be distinguished.

First of all, the seed teguments of *Phaseolus Mungo* and *Ph. aureus* are clearly distinguished from the teguments of *Phaseolus vulgaris* and *Ph. multiflorus* by the number of layers which form them and is 3 instead of 5. On the other hand, the teguments of certain other members of the genus *Phaseolus*, such as *Ph. calcaratus*, have also 3 layers, but the sub-epidermal layer is quite different. In the tegument of the seed of *Phaseolus Mungo* are found from the outside inwards :—

1) An epidermal layer formed of cells of which the cellular cavity, which contains a green substance, is club-shaped; the cavity, very narrow above, becomes very wide at the point of contact with the sub epidermal layer;

2) A sub-epidermal layer in which the cells, which also contain a green substance, are dumb-bell shaped with equal extremities, the cells having all hexagonal passages regularly between them;

3) A parenchyma with thin walled cells, elongated tangentially, those in the last layers being much flattened.

In *Phaseolus aureus*, the number of layers is also 3, but the cells of the sub-epidermal layer, whilst also constricted in the middle, are not so clearly dumb-bell-shaped, for the lateral walls of the cells are more regulary concave instead of being almost straight in the constricted part. Consequently the passages, on a transverse section, are roughly oval and have not, as in *Ph. Mungo*, the form of a radially elongated hexagon. Lastly the presence of these passages is not so constant as in *Ph. Mungo ;* the passages may be wanting here and there.

Generally, the seeds of *Ph. Mungo* have a blackish green tegument more or less spotted with orange yellow, with the hilum slightly projecting, while in those of *Ph. aureus* the tegument is more uniformly green with a hilum not at all or scarcely prominent The " dau xanh " or green kidney bean of Indo-China distinctly belongs, by the character of its seed tegument, to *Ph. aureus*, as had previously been recognised morphologically by MERILL and CHEVALIER.

806 – **Detection of Hydrocyanic Acid in Natural Cyaniferous Glucosides by two Microcristalline Reactions** (1). — DENIGES, G., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 6, pp. 309-310. Paris, Feb 12, 1921.

The reaction suggested by the author for the detection of prussic acid is: — 1) The production of oxaluramide by the action of NH_3 on alloxan in the presence of HCN (which acts as a catalyst) ; 2) the production of murexide by the action of pyridine on alloxan in the presence of HCN.

The alloxan reagent is prepared in a few minutes by heating slightly in a strong test tube until quite clear, a mixture of 1 gm. of pure uric acid, 1 cc. of nitric acid (1.39-1.40) and 1 cc. of water. To the clear liquid is added 50 cc. distilled water. To use this reagent for the detection of HCN in plants containing cyaniferous glucoside, a few grammes of the plant product are grated or ground, and pounded in about the same weight of water, then placed in a very short test tube, a kind of glass cup with wide spread edges not more than 3-5 cm. long and 15—18 mm. in diameter, filling it to within a few millimetres of the mouth, and left alone for a few hours. At the end of that time the cup is covered with a sheet of glass at the centre of which is placed a small drop (2—3 mm in diameter) of the alloxan reagent rendered alkaline at the moment of use by a very small quantity, of commercial ammonia diluted to $^1/_5$ dropped into it by means of a pointed glass rod. The glass is then turned over when placing it on the cup so that the reagent is on the under surface of the glass and in the centre of the mouth of the cup.

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(1) See *R.*, Dec. 1914, No. 1101 ; *R.*, Nov. 1918, No. 1227. (*Ed.*)

After a time varying according to the conditions (degree of division temperature, glucoside content, etc.) in which the test is made (generally 4 to 10 minutes) a thickening appears caused by crystals of oxaluramide in star shaped groups.

By replacing the ammonia diluted to $^1/_5$ by an (approximately) equal volume of pyridine, the reaction which is indicated by the appearance of fasciculate crystals, is still more delicate. Often the mixture becomes rose tinted owing to the action, on an excess of alloxan, of dialuric acid which is formed at the same time as oxaluramide and gives murexide.

807 – **Analyses of Saltbush Varieties *(Atriplex spp)*. and Fodder Values Determined in New South Wales** (1).— GUTHRIE, F B., in *The Agricultural Gazette of New South Wales*, Vol XXXII, Pt 3, pp 207-210. Sydney, March 1921

The following 3 varieties of saltbush were identified and analysed at the Botanic Gardens, Sideny, in order to discover the potash value in each : — Creeping saltbush (*Atriplex leptocarpa* F. Muell.) ; red berried saltbush (*Chenopodium triangulare* R. B.,) and old-man saltbush (*Atriplex nummularia* The composition of both crude ash and of pure ash exclusive of carbon dioxidè, sand and charcoal are given in tabular form. *A. leptocarpa* was found to be the most satisfactory of the 3 varieties and showed in the first case (crude) potash content of 34 96 % compared with 29.96 % C. *triangulare* and only 13.88 % *A. nummularia ;* and in the second case (pure) a potash content, of 41.88 % 39.29 % and 15.69 % respectively

TABLE I. — *analyses of ash of saltbush.*

	Atriplex leptocarpa		*Chenopodium triangulare*		*Atriplex nummularia*	
	Crude ash	Pure ash	Crude ash	Pure ash	Crude ash	Pure ash
Carbonic acid . . .	10.36 %		15.22 %	—	7.69 %	—
Sand	5.56		6.86	—	2.44	—
Charcoal	0.60		1.68	—	1.40	—
Silica	4 83	5.78 %	4.25	5.56 %	2.16	2.44 %
Iron and alumina .	0.93	1.11	2.78	3 64	3.65	4.35
Lime	7.36	8 82	15 14	19.85	5.29	5.98
Magnesia.	3 94	4.72	3.10	5.16	1.94	2.20
Potash	34.96	41.88	29 96	39.29	13.88	15.69
Soda	8.38	10.04	5.55	7.28	32.15	36.34
Chlorine . . .	23.87	28.59	12.64	16.60	30.25	34.19
Sulphuric acid .	2.80	3.35	2.94	3.86	4.46	5.04
Phosphoric acid	1.98	2.37	1.96	2.57	1.49	1.68
	105.57	106 66	102.08	103.81	107.00	107.91
Deduct oxygen equivalent of chlorine.	5.38	6.44	2.85	3.74	6.80	7 71
	100.19	**100.22**	**99.23**	**100.07**	**100.20**	**100.20**

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(1) See *R*, July, 1921. No Fos (*Ed.*)

Some years ago the author made some analyses to determine the fodder value of several varieties of salt bush from Bourke and Hay in New South Wales. The figures are calculated to dry substance, owing to the variation in moisture content on arrival at the laboratory. When quite fresh the leaves contain normally about 75 % water. The specimens examined were: *A. nummularia*; *Rhagodia parabolica*, *R. Billiardieri*, *A. halimoides*, *A. Angulata*, and one unidentified specimen.

In addition to this in order to compare the fodder value of salt bush with that of other common green fodders, the following table has been compiled, in which the analytical figures are presented in the usual form and recalculated to a moisture content of 75 %.

TABLE II. — *Comparison of saltbush with other green fodders.*

	Average 3 samples from Bourke	Average of 3 sample from Hay	Maize	Sorghum	Lucerne	Timothy
Water	75.00 %	75.00 %	79.3 %	79.4 %	71.8 %	61.6 %
Oil	0.47	0.61	0.5	6.5	1.0	1.2
Albuminoids	2.37	2.52	1.8	1.3	4.8	3.1
Carbohydrates	10.55	7.78	12.2	11.6	12.3	20.2
Woody fibre	3.52	3.98	5.0	6.1	7.4	11.8
Ash	8.09	10.11	1.2	1.1	2.7	2.1
Percentage of common ash	53.06 %	51.03 %	—	—	—	—

A comparison of the above, shows that saltbushes take a high place among green fodders, the amounts of carbohydrates and albuminoids being high, and the woody fibre relatively low. The high content of mineral matter, especially of common salt, is of course characteristic. In discussing their merits as fodder, it should be remembered that saltbushes possess natural advantages over the ordinary cultivated crops or pasture grasses. They flourish on land which will not support other fodder crops; they resist drought to an exceptional degree; are indigenous, and require no cultivation; are relished by stock, and are exceedingly prolific and easily propagated.

It appears, however, that in spite of the universal recognition of these facts by stock owners, there is some danger of these plants becoming less abundant than formerly, through overstocking and other causes. In California, a number of species have been imported from Australia for the purpose of cultivation on the alkaline soils of the State. The author considers it practicable and profitable to encourage the spread of these plants in the drought stricken districts of New South Wales, and to propagate by seed, cuttings and root. In good seasons there seems to be no reason why saltbush should not be cropped like lucerne and conserved as dry fodder for times of drought

[806]

808 - **Commencement of Work at the New Plant Breeding Station at Aberystwyth (Wales).** — STAPLEDON, R G, in *The Journal of the Ministry of Agriculture*, No 7, pp 630- 639, 5 figs. No 8, pp 739-742, figs 2 London, Oct and Nov 1920

The climatic and soil conditions of Wales are very distinct from those of the neighbouring English counties and require the selection of types with special characters suitable to the local physical environment. An endowment made by Sir. PHILLIPS has recently enabled a Plant Breeding Station for Wales to be created, which began its work in May 1919, in close connection and association with the Agricultural College of Aberystwyth

The Station comprises:

I. — A large laboratory for the practical work of students. It can accomodate 30 persons

II. — Three special laboratories for the staff, intended for the investigation, selection and control of samples, microscopic observation, chemical analyses, etc

III. — A special laboratory for Agricultural Botany and another for Plant Pathology.

The Station is also provided with rooms for collections, storerooms, drying rooms, etc, and has at its disposal 100 acres of land for selection tests and cultivation.

Owing to the character of agriculture in Wales, a grassland country, the work of the Station from the commencement has been devoted to the improvement of grasses and leguminous forage plants

To facilitate the study of individual plants sowing is made in movable boxes and the plants transplanted later. To prevent contamination from seed which may be in the soil, the soil used for the boxes is heated to kill such seeds, germination is started in incubators and the germinated seeds planted in the boxes; in this way a germination test is also provided. The ordinary arrangements to protect the plants from outside pollination have also been provided.

Besides indigenous grasses and leguminous forage plants, several exotic species which may possibly be useful for hybridisation have been introduced, such as: —

Trifolium subterraneum, which gives a good crop late in autumn.

Phalaris nodosa, from South Africa, resistant to drought and frost.

Danthonia pilosa, from New Zealand.

Eragrostis abyssinica, not suited to the moist, cold climate of Wales.

Trifolium alexandrinum, *Hedysarum coronarium*, *Cicer arietinum*, *Chloris Gayana*, and *Andropogon halebensis* also give completely negative results.

Regarding the improvement of local varieties they should comply with the following requirements: —

1) Lateness in flowering to prolong as much as possible the grazing season.

2) Growth of leaves as compared with growth of stem.

3) Good yield of hay (leaves).

Most of the experiments made relate to *Dactylis glomerata*; investigations have beeen made both on indigenous varieties and on numerous Danish, American, and French types.

The indigenous varieties proved superior to the exotic varieties in earliness and leaf production. They have all the character of population with distinct forms with which it should be possible to obtain, by selection, notable improvement in the direction desired. This work of selection has already been started.

Among grain crops, oats is no doubt the most important. Two distinct types are required; one for low elevations and flat country, the other for high elevations near the extreme limit for oat cultivation.

At the higher altitudes *Avena strigosa* and the native black oats are cultivated; at lower altitudes, besides the local black oats, some new varieties such as " Abundance " are grown. In any case earliness and resistance to lodging are essential, combined with good production both in quality and quantity.

The preliminary work is developing in three directions:—

1) Critical botanical study of the native oats to ascertain their agricultural character and to classify them.

2) Systematic study of oats in general.

3) Comparative cropping experiments.

It has been found from a preliminary examination that the local black (Ceirch du Bach) are polymorphous. The author thinks that 5 distinct forms can be isolated, among which one is grey.

At present at least 154 varieties are being tried, among which will be chosen those which are most suitable for further selection and hybridisation.

809 - On a Probable Case of Complete Repulsion of Two Factors in a Di-hybrid. — TJEBBES, H., and KOOIMAN, H. N., in *Genetica III*, Part. 1, pp. 28-34. The Hague, Jan. 1921.

By crossing the striped dwarf Prague kidney bean (seed with wine red stripes on a buff ground) with the light brown Dutch dwarf kidney bean the authors obtained in the F_2 plants in which the two parent types and the intermediate type were found in the ratio 1 : 1 : 2. The F_3 generation confirmed this result; the brown specimens gave descendants exclusively of the brown type; the Prague specimens gave descendants of the Prague type, whilet the descendants of the intermediate specimens were divided into 1 brown, 1 Prague and 2 intermediate (as in F_2).

At first the authors thought that it was a case of Mendelian segregation of characters, in accordance with the typical diagram of a monohybris, and admitting that the Prague type possesses in addition a genetic factor *S* which would determine the stripe by exerting an inhibitory action on the development of the colour. In a heterozygous condition, this factor would not completely suppress the formation of the brown colour, and brown mottling on a buff ground, characteristic of the F_1 generation, would result.

Subsequent research and records have shown that it was quite a different matter and that it was a most interesting phenomenon, namely a probable case of complete repulsion of two factors in a di-hybrid. Genetic literature speaks of two types of mottling in seeds : — constant mottled races, and inconstant mottled races. The latter are submitted to the action of a chromogenic factor present in the heterozygous condition, and, which KOOIMAN designates by the letter B.

In the present case the brown kidney bean possesses the chromogenic factor B ; the hybrid with striped seed would be heterozygous relatively to B ; the Prague kidney bean ought therefore to have the formula bb and possess the factor S which determines the stripe.

On the other hand, the brown kidney bean crossed with a number of other varieties which neither possess B nor S has never produced striped forms ; the presence of S in the cryptomeric condition (hidden by B) can therefore be scarcely admitted. Only one possible explanation remains : — The brown kidney beans have the formula BB ss, the Prague kidney beans the formula bb SS and they differ by two factors, but the two factors B and S exclude each other reciprocally in an absolute manner. According to this hypothesis, the formation of gametes BS and SB is suppressed and there are only the gametes Bs and bS. The following combinations are obtained from them in the F_2 : — Bs × Bs = BB ss = brown kidney beans.

Bs × Bs	=	BB ss	=	brown kidney beans.	)	1
Bs × bS	=	Bb Ss	=	intermediate type of F_1	(	2
bS × Bs	=	Bb Ss	=	» » »	(	
bB × bS	=	bb SS	=	striped Prague type .	)	1

On admitting the complete repulsion, which seens to explain these phenomena quite well, it is easy to picture the existence of a di-hybrid which carries out a diagram of division of character corresponding to that of a monohybrid.

810. – Mass and Pure-line Selection to obtain Types of Noè Wheat Resistant to Brown Smut in Italy. — MORETTINI, A., in *Le Stazioni sperimentali Agrarie*, Vol LIII, Part 10-11, pp. 399-413. Modena, 1920.

Results of a series of selection operations made with the object of obtaining types of Noé wheat less susceptible to brown smut (*Tilletia Tritici* Wint. and *Tilletia laevis* Kuhn). Both selection in bulk and selection by pure lines were used.

SELECTION IN BULK. — During the year 1912-1913, 500 gm. of sound seeds from healthy plants, 500 gm. of sound seeds from affected plants, and the same quantity of seeds of Common Noé crops were taken. These seeds were infected with spores of brown smut from *Tilletia Tritici* (Bjerk) Wint., collected the same year and sown in 3 separate plots. At harvest time the plants in each plot were pulled up separately and the healthy plants, affected plants, healthy ears, smutted and partially-smutted ears, of Noè were counted. The percentages of healthy ears and smutted, ears in the year of selection and control were approximately the same as those of 1911.

	Ears	
	sound	rusted
a) Control not infected	100	—
b) Seed selected from rusted or recently infected ears . .	61	39

	Sound ears	Smutted ears
a) Control not infected	100	—
b) Seed selected from rusted or recently infected ears	61	39
c) Seed selected from sound ears on smutted tufts recently infected	54	46
d) Control infected.	34	66

These are distinctly positive results. On the other hand, selection in bulk enables selection to be made on a large number of plants, and consequently makes it possible to test a large number of types in the variety, thus making future line selection more sure by the elimination of the types more susceptible to attack.

SELECTION BY PURE LINES. — In the crops of the 4th year of selection, 10 heads of line, of which 3 were quite sound, 4 with sound and smutted ears, 2 with sound, smutted and partially smutted ears, were taken. For sowing the author took the seeds from the sound and partially smutted ears as indicated in the following table :—

	sound	smutted	sound and smutted	sound	sound and smutted
I	1	2	3	1	[illegible]
II	1	12	1	1	1
III	1	6	3	1	3
IV	1	12	3	1	3
V	2	5	—	2	—
VI	1	9	—	1	—
VII	4	2	—	3	—
VIII	7	—	—	3	—
IX	8	—	—	4	—
X	3	—	—	4	—

The sound seeds were collected from each ear, separately; they were infected the day before sowing with the spores of *Tilletia Tritici* and then sown separately.

Following on the elimination of the less resistant families and the multiplication of those which responded best to selection, in 1917, of the 10 plants heads of line under examination, only 4 remained, that is to say, the descendants of plants heads of line I, III, VII and VIII. The recapitulatory Table indicates the percentages of sound smutted and partially smutted ears of the selected plants and the control plants during the three years 1915, 1916 and 1917.

Comparison of the percentages of sound smutted, and partially smutted ears in the selected crops and in the control crops.

Years		Sound ears	Smutted ears	Partially smutted ears
		Per cent.	Per cent.	Per cent.
1915. . . .	Selected plants . . .	71.13 %	27.21 %	1.66 %
»	Contiol plants	50.55	49.45	0.00
»	*Difference* . .	**20.58**	**22.04**	**1.66**
1916. . .	Selected plants	50.68	37.10	12.78
»	Control plants	22.72	76.84	1.44
»	*Difference* . . .	**27.96**	**39.74**	**11.34**
1917	Selected plants.	33.61	40.73	23.66
»	Control plants	9.90	86.46	3 64
»	*Difference* . . .	**23.71**	**43.73**	**20.02**

This Table shows a perceptible and constant difference in favour of the selected plants and that difference is still more marked if the partially sound ears, very numerous in the selected families (in 1917 they constituted 23.66 % of the crops and 3.64 % of the control crop) are taken into account. In varieties of wheat, even very susceptible (as Noè really is), resistance to brown smut can therefore be increased by selection to a by no means negligible extent.

811 - **Transmission of the Abnormal Character "Zig-Zag" Culm in Maize.** — EYSTER W. H., in *The Journal of Heredity*, Vol. IX, No. 8, pp. 349-357, figs. 9. Washington, Nov.-Dec. 1920.

Some of these abnormal plants, self-fertilised, gave descendants with zig-zag culms and, on the other hand, by crossing with the normal type, normal plants were obtained in F_1.

The anomaly appears only at the time when the male inflorescence comes out and it concerns the region where the ears are inserted. The decrease in the height of the culm is naturally greater when the number of internodes affected is greater and the phenomenon is more accentuated; it produces also a shortening and thickening of the internodes. The leaves appear normal, but the sheaths, instead of surrounding the internode, are separated out just because of the zig-zags of the culm.

From the commencement this character has shown itself recessive: plants, of the F_1 cross of normal × abnormal are normal. In F_2, the author obtained 343 normal and 23 plants with zig-zag culms, according to a ratio which is nearly the theoretical ratio of 15 : 1, existing when two factors or determinants are concerned. It follows from these data that the character "zig-zag culm" is based on at least two recessive factors.

812 - Genetic Analysis of the Descendants of a Cross between the Prague Climbing Kidney Bean and the Dwarf Kidney Bean. — Tjebbes, K., and Kooiman, H. N., in *Genetica*, III, Part 1, pp. 34-49. The Hague, Jan. 1921.

From a cross between the Prague mottled climbing kidney bean fertilised with pollen of the Hague white dwarf kidney bean the following results were obtained in F_1: —

	Father	Mother	Hybrids of F_1
Habit. . . .	dwarf	climbing	climbing
Flowers	white	lilac	violet
Pods	light streaked azure	bright red stripes	dark blue stripes
Seeds.	white	white stripes colour of wine dregs	grey stripes

In the F_2 generation there was a very complicated disjunction of characters. For each of the characters taken by itself there were: —

Habit: — 12 dwarf, 21 climbing.

Flowers: — 10 dark violet: 12 light violet: 10 lilac; 11 white.

Pods: — (stripes) 22 dark blue; 8 light blue; 10 bright red; 3 pale red

Seeds: — 11 white; 32 coloured (with stripes).

The 32 coloured seeds were subdivided as follows. — 11 white; 5 black; 13 grey-blue; 1 dark violet; 3 light violet; 5 brown-black; 4 reddish grey; and 1 wine dregs colour.

A close study of the F_2 and of a crop in F_3 enabled the key to be found which served to explain these forms of disjunction of characters. There is, doubless, linkage between the colours of the flowers, pods and seed, linkage and relationship which the authors have interpreted by admitting the presence of two factors for the colour of the pods, flowers, and also, in part, of the seed, and one factor (or perhaps a group of factors) which influences exclusively the colour of the seed.

The two parents have in common striped pods, and the palest of these stripes (pale red) is only found in the hybrids of the F_2 and F_3 generations.

The Prague kidney bean has a factor S which has the following properties: —

1) It changes the pale colour of the stripes in the pods into a fine bright red.
2) It produces the lilac colour in the flowers.
3) It produces a wine dregs colour on the surface of the spermoderm. That colour can only be shown by the stripes.

If the factor S in lacking: —

1) The pods have pale stripes.
2) The flowers are white.
3) The seeds are white.

The Hague kidney bean has a factor BL which:—

1) Changes the colour of the stripes on the pods into blue.
2) Changes the lilac colour of the flowers into violet.
3) Changes all the colours of the seed by accentuating all the bluish shades.

In the absence of S, the factor BL only shows its action on the pods.

Regarding the seeds, the black, bluish grey, dark violet and light violet groups have BL, while the brown black, reddish grey and wine dregs groups lack it.

Further, the Hague kidney beans have one (or two?) factor Z, which acts on the shade of the seeds by deepening the tint: — dark violet become black; light violet, bluish grey; red wine dregs, dark brown; pale red, reddish grey.

In the pods and in the flowers the factor S is manifested in the same way in both homozygotes and heterozygotes. But in the seed a quantitative difference in noted between the SS and the Ss: — the black, dark violet, brown and the red wine dregs are homozygotes (they never produce plants with white seeds), while the grey blue, light violet, reddish grey and pale red are heterozygotes for S and produce in F_3 plants with white seeds.

The factor BL influences the pods and seeds of the homozygotes, in the same way as those of the heterozygotes; on the other hand a difference appears in the flowers, and the homozygotes have a much deeper violet colour than the heterozygotes.

Finally, the difference in aspect (climbing or dwarf) between the two kinds is governed by a single factor, since a segregation corresponding entirely to the diagram of a monohybrid is produced in the second generation.

813 - **Contribution to the Selection of Flax by Pure Lines' in Hungary.** — FLEISCHMANN, R., in the *Zeitschrift für Pflanzenzuchtung*, Vol. VIII, Part. 1, pp. 26-43. Berlin, March, 1921.

The "Saatzucht-und Saatgutverwertungs A. G." (Seed Selection and Trading Co.) has a plant breeding Station on its estate at Debrö (Heves, Hungary). From the commencement of its operations and on the initiative of the General Manager ELEMÉR SZÉKÁCS, the Station has paid particular attention to the selection of flax. Although the period of its researches has been short (since 1919), the results already obtained nevertheless deserve special attention. The material for the first operations of selection was in the form of "populations", or a mixture of distinct forms all belonging to *Linum usitatissimum* L., of the closed-capsule type. The first selection bore on the length of stalk: there is a form of flax in which the plants have mostly short stalks (45 cm.), mixed with a small proportion (2-3 % as a maximum) of long stalked plants.

The short stalked plants are also distinguished by more abundant foliage, wider light green or grey green leaves, abundant branching, larger and more numerous capsules and also larger seeds.

There are many intermediate types between the two extreme forms.

The operations were at first upset by several adverse circumstances and could not be started regularly until June 30, 1919.

Sowing was carried out in 1 m. lines; 50 seeds per line; spaces between the lines 15 cm. When mature the plants were measured for two standards of length: — 1) From the bottom of the stalk up to the first branch; 2) from the first branch to the top. As a general average for 49 series of selection the lengths were: —

First length 60.5 cm. *minimum* 40.4 ± 1.87; *maximum* 73.1 ± 0.65 cm.

Second length 22.88cm. (18.3 — 30.1).

In the control plots (same plants without selection) the average for the first length 51.36 cm. *minimum* 33.42 ± 0.323; *maximum* 59.74 ± 0,452.

There was therefore already a gain of about 10 cm. in the first year.

A series of coefficients for measuring the correlation between the parents and the descendants has also been calculated and in each case very high values have been obtained.

(1) Total length of the parent plants and average length of the descendants: — $r = +\ 0{,}647 \pm 0{,}059$.

(2) Length of the unbranched portion of the stalk of the parents and average total length of the plant in the descendants: — $r = +\ 0.7165 \pm 0.0496$.

(3) Length of the unbranched portion of the stalk of the parents and of the descendants -- $r = 0.7300 \pm 0.048$. The results obtained were also confirmed by subsequent work.

Besides length of stalk, other characters such as number of seed per capsule, shape, dimensions and colour of the seeds can form so many distinctive characters by pure lines. And it is in this sense that the author proposes to amplify and continue his researches.

814 - "*830* C Katharine'" a New Type of Whortleberry obtained by Hybridisation in the United States. — COVILLE, V., in *The Journal of Genetics*, Vol. XI, No. 8, p. 338, 1 fig. Washington, Nov-Dec. 1920.

By crossing two wild plants of *Vaccinium corymbosum*, known by the names of "Brooks" (Greenfield, N. H.) and "Sooy" (Browns Mills, N. J.) many hybrids were obtained, the best of which, "830 C Katharine" is the subject of the present article.

This is a new type that is really valuable on account of its colour, perfume, the compactness of its berries, and also because the seeds are so small that they are scarcely noticed when the fruit is eaten.

Scarcely 3 % of the berries are less than 12 mm. in diameter; while the largest berries attain a diameter of 18 mm. The material required for propagation has already been entrusted to several horticulturists.

A specimen of this variety has been deposited at the Economic Herbarium of the U. S. Ministry of Agriculture.

815 - **Rice Irrigation Measurements and Experiments in Sacramento Valley California, 1914-1919** — ADAMS, F., in *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* No. 325, pp. 47-69, tables 10, figs. 4. Berkeley Ca., Sept 1920,.

The author refers to a previous Bulletin describing Californian rice irrigation practice, and methods of preparing land for irrigation, employed a the Biggs Rice Field Station, giving results of measurements of the amounts of water used and the subsequent yields for 1914-1916 (1). Further measurements have since been made there and also on a different type of soil on the west side of Sacramento Valley, on the Spalding Ranch, near Norman, and the author here summarises and discusses both the earlier and later measurement and experiments; also gross measurements of use of water on rice fields, taken from operation reports of canal companies and from measurements of diversions from Sacramento River in 1919 by the State Department of Engineering in part cooperation with this Station, are reported in the appendix.

In 43 full season measurements of the amount of water used in rice irrigation from 1914 to 1918, the total depth of water applied ranged from 3.91 to 18.70 ft., and the net depth, after deducting measured or estimated waste ranged from 3.91 to 13.43 ft. The average net depth of water applied to 22 404 acres under investigation was 4.89 ft. Of this area 21 419 acres was clay or clay adobe of the willows Sacramento, Stockton or Capay series.

An annual depth of 5 feet of irrigation water for rice is sufficient for the principal soils of Sacramento Valley, i. e. for the above mentioned districts: pervious loam soils, however, required an excessive amount of irrigation water, and from the water-standpoint are not suitable for rice growing. The use on individual fields of 1 cub. ft. per second of irrigation water to 30 to 40 acres during the first flooding after sowing is not excessive. Owing to the fact that all growers are not ready for the first flooding at the same time, canal diversions at this rate are not necessary, although it appears that probably as much as 1 cub. ft. per second to about each 50 acres served, is desirable during the period of initial flooding. The seasonal use averages about 65 acres per cub. ft. per second.

The following table shows the results of experiments on the effects of yield of slowly changing water, stagnant water, no submergence, and fluctuation of depth during submergence; submergence begun 30 days after emergence.

The maximum rice yields were obtained from submerging rice fields 6 inches deep (30 days after emergence), except on alkali land from which the best yields were obtained from submergence starting 15 days after emergence.

Constant movement of irrigation water through the rice checks during the period of submergence is necessary only where the soil contains alkalis

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(1) See *R.*, June 1918, No 625. (*Ed.*)

Year	Location	Yield of rice in lb. per acre with different water treatments: Slowly changing water: 6 inch submergence	Stagnant 6 inch submergence	No submergence but soil kept moist	Fluctuation of depth of submergence
1914	Biggs	4 790	4 940	2 440	5 290
1915	»	4 210	3 990	2 480	4 160
1916	»	3 460	3 800	2 100	3 690
1917	»	4 230	4 405	2 490	4 360
1918	»	3 615	2 550	2 860	3 625
1919	»	3 000	2 600	1 250	2 950
1918	Norman	2 670	2 504	1 800	3 187
1919	»	2 212	1 239	2 265	2 909
Average for Biggs . . .		**3 884**	**3 714**	**2 270**	**4 012**
Average for Norman . .		**2 441**	**1 871**	**2 033**	**3 048**

in sufficient quantities to affect the plants. The author lays special emphasis on the fact that the continued growing of rice on loam soils not underlaid by an impervious stratum that prevents deep percolation of water will result in very serious damage. It is imperative that ground water and rise of alkali be controlled in Californian rice fields both by confining rice growing to the heavier impervious clays and clay adobes, and by thorough and adequate drainage facilities embracing the entire areas affected or likely to be affected. A prime factor in control of water-grass in rice fields is to keep the banks of canals and irrigation ditches, principally the main and field laterals, entirely clean either by pulling or cutting the grass or by pasturing sheep on the ditch banks *before the seed has formed.* Keeping drains and sloughs free of both water grass and tules is also absolutely necessary if the danger is to be minimised.

The effect of irrigation methods and treatment on yields and of varying the date of submergence of rice fields with the 6 inch submergence at the Biggs Station was shown for the years 1914, 1915 in the preceding bulletin and is here supplemented with the data to hand for years 1917-19.

The author gives also summaries of measurements of duty of water, grouped by soil types and arranged in order of depth of water applied, and also of areas of land served per cub. ft. of water per second ; the variation in water temperatures compared with different depths of submergence and the evaporation records. With reference to the last mentioned, about one third of the water applied to rice fields is said to be lost by evaporation from the surface of the standing water during submergence. This cannot be controlled, but is in a way a measurable factor.

The figures illustrate the relative growth under different depths os submergence.

	Irrigation treatment	Field in rice in lb. per acre.		
		1917	1918	1919
Biggs. . .	15 days after emergence of plant . . .	4 220	3 420	1 700
Norman. .	15 » » » » . . .	—	3 568	2 682
Biggs. . .	30 » » » » . . .	4 500	4 185	2 230
Norman. .	30 » » » » . . .	—	3 108	2 809
Biggs. . .	45 » » » » . . .	4 310	3 240	2 050
Norman. .	45 » » » » . . .	—	2 604	2 096
Biggs. . .	60 » » » » . . .	4 040	4 115	1 980
Norman. .	60 » » » » . .	—	1 933	1 650
Biggs. . .	Submergence maintained 2 in. deep . .	4 260	4 635	3 000
Norman. .	» » » » » . .	—	2 722	2 452
Biggs. . .	» » 4 » » . .	4 440	4 215	2 990
Norman. .	» » » » » . .	—	3 154	2 275
Biggs. . .	» » 6 » » . .	4 520	4 035	3 050
Norman. .	» » » » » . .	—	3 425	2 747
Biggs. . .	» » 8 » » . .	4 480	4 015	2 710
Norman. .	» » » » » . .	—	3 132	1 876

816 - ***Panicum minutiflorum* and *Andropogon rufus*, Good Brazilian Forage Plants** (1). — GABBATO, C, (Viamão Experimental Station, Brazil), in *L'Agricoltura coloniale*, Vol. XV, No. 1 pp. 18-19, figs. 2, Florence, Jan. 1921.

Two forage plants which promise to give good results on most soils in Brazil are *Panicum minutiflorum* (= *Melinis minutiflora*), and *Andropogon rufus*.

Experimental crops grown for some years in Rio Grande do Sul, have given results which warrant the recommendation of these plants in countries of similar mesological conditions (such as Southern Italy and its islands) both for hay, pastures, or permanent meadows.

Panicum minutiflorum or " capim gordura " (fat forage) is a grass with broad leaves, coated with a gummy aromatic substance, with a panicle made up of small rose coloured ears, with very small seeds. The plant forms tufts in which culms are on an average 50 cm. high.The culm is tender and remains so until the autumn frosts, when it dies; the roots remain alive and sprout vigorously in spring. The hay is very easily saved and, either as hay or in a green state, the forage is much liked by animals.

The percentage composition of the hay in digestible matter is as follows: — Total dry matter 78.90 %; proteins 8.42 %; nitrogen free extract 60-51 %; fat 1.75 %. Its nutritive ratio is therefore 1 : 7.7.

Andropogon rufus Jaq. is another grass of extraordinary growth. It forms large tufts of stiff culms, with rather solid rose coloured leaves. The stalks reach a height of 2 m.; they are woody and not much liked by animals: the grass should therefore be mown before it flowers or fed as pasture at that period so as to make the most of it for feeding animals. The hay is easily made. The percentage composition of hay of this *Andropogon* in digestible matter is as follows: — Dry matter 81.05 %; in proteins 5.78 %; nitrogen free extract 64.74 %; fat 1.01 %. Nutritive ratio 1 : 11.6. In Brazil this grass is called "capim jaraguà". The two above mentioned grasses are propagated by seed which retains its germinating power for a long period. The seed is sown at the beginning of spring. The grass can be cut 3 or 4 times a year and average yields of 1000 to 1500 quintals per ha. are obtained. Of the two plants *Andropogon* is preferable for moist fertile soils and *Panicum* for less fertile soils in the hills and plains. Owing to the difference of composition in digestible matter of the two grasses and the greater amount of nitrogenous matter in *Panicum* forage, the latter is more suitable for growing animals, while *Andropogon* forage is better suited to full grown animals.

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(1) See *R.*, 1915, No. 201; *R.* 1917, No. 18. (*Ed.*)

817 - **The "Caulet de Flandre" Cabbage.** — MANVILLI, C., in the *Giornale di Agricoltura della Domenica*, Year XXXI, No. 24, pp. 186, figs. 2, Piacenza, June, 12, 1921.

The author reports the good results which he has obtained by the cultivation of the "Caulet de Flandre" forage cabbage at the "Istituto agricolo Bonafous". This cabbage, also called "rouge de Flandre" or "rouge de l'Artois", may be considered as a sub-variety of "chou Cavalier" or "grand chou à vaches", from which it differs by its smaller height and by the green red or violet red of its stalk, petiole and the nerves of the leaves. The stalk easily attains a height of 1 m. or more; the leaves are large, the flowers yellow. It is a hoed crop which should normally be placed at the beginning of a rotation; but its special method of cultivation and the time during which it occupies the ground often causes the combination crops to be modified. Thus it is often grown after forage crops harvested early, after rye and vetch, red clover, rape, etc. ; and as it is not cut until the following spring. it can be followed by spring cereals : — oats maize, sugar beet, etc. so that it can then be considered as a regular catch crop. According to the author's observations, sowing, which should be made in nursery beds, should be rather open so as to give vigorous plants: 150 to 175 grammes of seed per are suffice. One are to 1.5 ares of nursery is sufficient for planting out 1 hectare. Sowing may be done in March-April or July-August, and final transplanting in April-May or August-September, respectively, in lines spaced 80 cm. and the plants 50 to 60 cm. apart or else, as the author has seem in Belgium, in the Campine, spaced 70 cm. in both directions.

The crop is harvested from September to the following spring; harvesting is only stopped during severe winter frosts and consists in plucking the leaves, commencing with the bottom leaves which at that season begin to turn yellow; the plucking of the leaves requires much labour daily but at a season when field work is reduced to a minimum. The leaves are detached from the petiole so as not to damage the stalk and they are collected into bundles. The final cutting is made when the cabbages commence to flower; then the whole plant is given to cattle, which only eat portions of it. A total forage production of 450 to 600 quintals per hectare can be relied on.

The nutritive value of forage cabbage is greater than that of magolds; at least that is the author's impression, shared also by many breeders. The milk produced by cows fed on these cabbages yields a deep yellow butter without, however, impairing its quality. With daily rations of 35 kg. per head no ill consequence was noticed except when the cows were allowed to eat too great a quantity of cabbage in full flower.

818 – ***Atriplex leptocarpa, A. nummularia* and *Chenopodium triangolare* as Forage Plants in New South Wales.** — See No. 897 of this *Review*.

819 – **Sunflower Silage** (1) **in Western Canada and in Australia.** — I. HUTTON, G. H., Sunflower Silage for the West in *The Agricultural Gazette of Canada*, Vol. VIII, No. 2, pp 211-212. — Ottawa, March-April, 1921. — II SPAFFORD, W. J., Sunflowers in *Journal of Department of Agriculture of South Australia*, Vol. XXIV, No. 8, pp. 687-688. Adelaide, March 1921.

I. — Many comparisons made between maize silage of the best quality and sunflower silage have shown the balance of economy of gain in beef cattle and yield of milk in dairy cattle in favour of the sunflower. Similar results were obtained as regards peas and oats silage. The yield from sunflower silage was almost 35 tons per acre, or 5 times as great as that of the two latter crops. The following table indicates the yield in green weight per acre of the 3 above mentioned crops; the moisture content at the time the crops were put in the silos and the yield in dry matter per acre.

	I	II	
	lb.	%	lb.
Sunflowers.	79.200	82.41	12.034
Maize.	27.980	78.72	5·745
Peas and oats	14.000	62·64	5·230

If the seed is of good quality, 5 lb. per acre will be found sufficient so that the plants will be from 3 to 4 inches apart in the row and about 36 in. between the rows. The crop is ready for the silo when about 40 % are in flower, or when the first plants to flower have reached the dough stage

Sunflowers have proved an advantageous crop for growing under irrigation and also as a dry land crop, being distinctly drought resistant. The Experimental Station at Scott, Saskatchewan reports a yield of about 6 tons per acre with a precipitation or less than 2 in., during the growing season. Another important feature is its ability to withstand frost (it has been stated that it will withstand as much as 6 degrees of frost without injury). The author considers that this will become one of the main forage crops in Western Canada.

II. — Sunflower is coming into a considerable prominence as a summer-growing fodder crop in South Australia, and the following points relative to cultivation should prove of interest to prospective growers.

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(1) See *R.*, April 1919, No. 493. (*Ed.*)

A well developed crop grown without irrigation should give a return of from 14 tons to 20 tons of greenstuff per acre. In Australia a fair crop will carry 72 sheep per acre for one month and a heavy crop even more. It has been found that the maximum results are secured in harvesting when about ⅓ of the apex flowers have just opened, but the yield will be higher if the crop is harvested just as the first buds appear, and the land is cultivated between the rows, and the plants left to grow a second crop.

820 - **Possibility of Growing *Eucommia ulmoides* in Italy.** — VERNUCCIO, R., in *L'Agricoltura coloniale*, Year XV, No. 3, pp. 129-140; No. 4. pp. 229-240. Bibliography of 35 works. Florence, March and April, 1921.

Two very fine specimens of *Eucommia ulmoides* Oliv. (a rubber-producing magnolia, native of China) which are growing in the garden of the Botanic Institute of the University of Rome, were used by the author for the study of the internal and external morphology of the tree and, especially the vessels containing caoutchouc, and for experimental extraction of rubber from the tree.

The method of extraction adopted by the author and called by him the " medicinical-chemical method " was as follows : — Drying the leaves or the bark in the sun , trituration ; sifting ; washing in running water; fresh trituration; fresh sifting with water; after these operations the caoutchouc is almost completely purified. To agglomerate the filaments, they were dissolved in carbon bisulphide which on evaporation left the rubber in sheet form.

The author concludes that. *Eucommia ulmoides* is a rubber plant wich gives a considerable yield and which should be cultivated experimentally in Italy. It is rich in caoutchouc both in the bark of the trunk and roots and in the leaves ; it is possible, by the above mentioned mechanical-chemical method to obtain a fairly considerable yield of rubber ; there may be two crops of leaves a year. The tree can be propagated by cuttings.

821 - **Relation between the Height of Tapping, the Width of the Sectors Worked, the Frequency of Operations and the Rate of Renewal of the Bark in *Hevea brasiliensis*.** — VERNOT, G., in the *Bulletin de l'Institut Scientifique de Saigon*, Year III, No. 6. Saigon, June, 1921.

As a good tapper cuts away an average of 1 mm. of bark per day during the tapping period, the average height of bark cut away annually by continuous tapping on a single cut is about 40 cm. If the first incision is made at a height of 1.20 metres, it would take 3 years to reach the bottom of the tree ; the working of a fresh sector would then be started.

According to experienced planters and experimentalists, the proportional width of the sectors is very variable ; tappings over ½, ⅓, ¼, or $^1/_5$ of the circumference have each their supporters and opponents. How is it that after nearly 20 years of discussion and experiment on this subject agreement has not yet been reached ? The author says it is because of the fact that three variable factors : 1) Rate of renewal of the bark ; 2) width ; 3) height of the sectors tapped, are among the data of the problem to be solved and have not been taken into account.

Now, the rate or renewal of the bark is a problem which should be solved separately. The width of the sectors tapped should be decided experimentally and, as will be seen, the height of the sector should be a function of their width and of the time required for the suitable renewal of the bark.

Allowing that the experiments are made by commencing tapping invariably at a height of 1.20 metres, on sectors of varying proportional width of which each should last three years, it would require, before having to tap the renewed bark, that is to say to go round the whole circumference of the tree: —

6 years for tapping over $^1/_2$ of the circumference on a single cut.
9 » » › » $^1/_3$ » › » › › »
12 » » » » $^1/_4$ » › › › › »
19 » » » › $^1/_5$ » › › › › ›

It is at present admitted that it takes 6 years for the bark to be suitably renewed and fit for fresh tapping without ill consequences. It is evident therefore that, in these conditions, tapping over ½ of the circumference is the only method which agrees with this experimental datum. On the other hand, for the smaller working sectors, the yields are trifling while tapping is done in the upper part of the different sectors; they do not become suitable until the bottom of the trees is reached. To make a comparative examination in these circumstances is a great mistake. But the mistake is still greater when, while continuing the same experimental method, a fourth variable is introduced into the problem viz., the period of rest given to the trees between each period of tapping (tapping alternately every other month, one month in three etc.). For tapping on a single cut, commencing at a height of 1.20 metres the number of years indicated above would have to be doubled for tapping in alternate months and trebled for tapping one month in three. Very long periods are reached, which are not worth considering as regards the renewal of the bark. Any comparative yield experiment which neglects these simple data is very incomplete, since it does not take practical possibilities into account.

Contrary to the rough methods of former experiments, the preceding Table makes it possible to foresee an extremely sensible modulation as regards the investigation of tapping and also enables observations which may be made during tapping to be taken into account.

Supposing that it was recognised at any time that 6 years do not suffice for proper renewal of the bark; the whole of the trunk above the tapping being untouched, it will be optional, at each change of sector, to raise the height proportionally to the width of the sector and proportionally to the supplementary period of rest which has been recognised as indispensable. In spite of this change, provided it is simultaneous, the results of the experiment will be none the less perfectly comparative. But is the rate of renewal of the bark the same in all cases, whatever the system of tapping may be? On the contrary it appears to be clearly proved that tapping decreases the rate at which the wounds heal over; to what extent, in each method of tapping, may this fact be prejudicial to the continuity of the yields and to the vitality of the trees? Only long-period experiments can enable this to be determined

Regarding the recognition of the moment when the bark should be considered as regenerated, contrary to the general practice, the external appearance of the trunk of the tree alone should not be trusted. It is not uncommon, in practice, to hear it affirmed that the bark is completely renewed because it has reached the same level as the bark alongside. On the contrary, it suffices to examine, by means of small notches, the real thickness of the bark which appears to be reconstituted, compared with that of the virgin bark to find out that, nearly always, the former is thinner. The reason of this physiological phenomenon is well known; tapping, breaking through the band of bark which encloses the tree diminishes the resistance which the generative layer has to overcome to form fresh cells; consequently the hydrostatic balance at that level is upset and the cell production of the cambium takes place simultaneously both on the side of the wood and on the side of the bark.

Another point must be taken into consideration in examining the degree of renewal of the bark. The bark consists of two principal parts: — The true bark, which so to say contains no latex canals, and the liber, which on the contrary is largely supplied with them. It is therefore the liber which is especially of interest to the planter and investigations should principally bear on it.

And what is to be said when the experimenter, wishing to compare equal sectors tapped daily and tapped alternately, makes the former at 50 cm. and the latter at 80 cm.?

All depends however on this simple arithmetical problem. — If with daily tapping on a single cut 40 cm. of bark per annum is used up, and if 6 years are required for adequate renewal of the bark, the total height of the tapping sectors will be 40 × 6 = 2.40 metres, and that is so whaterer may be the width recommended for the sectors. That being granted, according as tapping on ½, ⅓, ¼ or $^1/_5$ of the circumference on one cut is adopted, it suffices to divide this figure of 2.40 metres by 2, 3, 4, 5, or 6 to get, by simple calculation, the suitable height for commencing tapping in each case.

Regarding alternate tappings every other month or one month in three the last-named figures will be divided, according to the case, by 2 or by 3 to obtain the required information.

The annexed Table gives the following results for tapping on one cut daily or alternately the height at which the incisions should commence according to the widths of the tapping sectors.

It should, be mentioned, however, that each time tapping is recommenced on bark left untouched for a certain time, the first renewed incision uses up a little more bark than the daily average That is to say that the figures given for the alternate tappings ought to be slightly increased. In practice it will suffice if the figures given are simply rounded off.

Concordance of the heights of tapping			
Tapping on one cut	Height of the tapping sector		
	Daily tapping	Tapping alternate months	Tapping one month in three
	Metres	Metres	Metres
on $^1/_2$ circumference	1.20	0.60	0 40
» $^1/_3$ »	0.80	0.40	0.27
» $^1/_4$ »	0.60	0.30	0.20
» $^1/_5$ »	0.48	0.24	0.16
» $^1/_6$ »	0.40	0.20	0.14

822 – "Windrowing" Method adopted for Preserving Sugar Cane from Rapid Deterioration in the North West Frontier Province, India. — I. ROBERTSON BROWN W, The Effect on the Economical and Agricultural Situation: II. The Efffect on the Composition of Sugar Cane. — HARRISON W. H., and SANYAL P. B (Imperial Agricultural Chemist), in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. V, No. 10, pp. 237-248. Charts 2. Calcutta and London, December, 1920

I. — A study of the American practice of windrowing (the term adopted by the sugar planters of Louisiana to describe their method of preserving sugar cane from rapid deterioration after the leaves and buds have been killed by frost), was undertaken at the Peshawar Agricultural Station, and the cane was first windrowed there in 1916.

The author describes in detail the 4 recognised seasons in the Peshawar valley and quotes the normals of temperature derived from data of 33 years for each successive month. The normal mean temperature from February to April (spring season) varies from 54.1 to 72.9° F; from May to July (summer) 54.0 to 90.9° F; from August to October (autumn), 88.6 to 73.1° F; from November to January (winter) 61.7 to 51.3° F.

As the average annual rainfall is only about 14 in. the sugar cane is irrigated from 20 to 25 times during its period of growth which extends from April to the end of October. By mid December the cane tops have been killed by frost. As the buds also are liable to be killed off in the same way, growers have long been accustomed to " clamp " a certain amount of their crop to preserve it for seed. If a grower has clamped more cane then is required to plant his field, the surplus cane is crushed, and, usually, the *gur* made therefrom is not inferior to that produced from the cane treated directly from the field: — that no deterioration occurs in cane thus treated from mid November till the end of March, has been proved by a series of analyses.

From a manufacturing point of view, clamping is however expensive (1 anna per maund to pit the cane and take it out again); it was therefore thought that the practice of windrowing might be of considerable advantage to a sugar factory; as this is a far les expensive operation. It consists of cutting the cane, laying it down, unstripped, where it was grown, the leaves forming a thatch which preserves the solid cane from the weather, and frost. On adopting this method late in November 1916, the cane after lying exposed for 3 months, was found to yield first class *gur*. This was a surprising result, as it is a well known fact that as a rule cane deteriorates more or less quickly, directly it is cut in all tropical parts of the so-called sugar cane belt.

II. — As a result, a scheme of investigations on a liberal scale was planned for 1917-18-19 and a report is here given of the changes found to occur in the windrowed canes from the point of view of the conservation of their sugar content.

In December 1917, a large average sample was drawn from a stand of the local *Pounda* cane and a careful analysis of the juice was made. The whole of the cane was windrowed on December 19 and allowed to remain there until April 5, 1918, when another average sample was drawn and analysed. The composition and equivalent weight of cane etc. before and after windrowing may be shown as follows: —

	Average weight of cane	Juice	Sucrose	Glucose	Brix (corrected)	Coefficient of purity	Crystallisable sugar
	lb.	%	%	%			lb.
Before windrowing on Dec. 5 . . .	2.39	75.84	9.57	2.38	13.34	71.70	8.06
After windrowing on April. 5	2.12	71.70	13.25	2.74	18.05	73.41	11.33

Crystallisable sugar has been calculated from the formula $C = S\ (1.4 - \frac{40)}{P}$ when C = % crystallisable sugar; S = % sucrose; and P = purity of juice.

It is evident from this analysis that the *quality* of the juice has improved and consequently, the yield of sugar from equal weights of juice would be greater after the period of windrowing.

A comparison of the estimates of the sugars present in a given quantity of cane before and after windrowing, shows that in addition to the superior quality of juice, the weight of sucrose and crystallisable sugar in the crop was materially increased after windrowing. This conclusion receives support from the analysis of a number of canes which had been allowed to remain in the ground throughout the cold season, and were analysed early in March.

If the values obtained when the cane is left standing throughout the season are taken as representing the maximum attainable under Peshawar conditions, then windrowing in December may be said to have led to a loss of 9.8 lb. of sucrose and 8.1 lb. crystallisable sugar for every 1000 lb. of cane standing in December 1917. Although it appears from this wisest to leave the cane in the ground as long as possible this is hardly practicable owing to the danger of considerable damage occurring through a " splitting frost ".

The analyses determined in 1918-19 indicated that although under Peshawar conditions, windrowing tends to reduce the purity of the juice, yet, owing to the latter becoming more concentrated, the percentage of crystallisable sugar remains fairly constant, and therefore, the practice of windrowing will not lead to any appreciable decrease in the amount of sugar obtained from equal weights of juice evaporation. The period during which canes can be stored varies with different seasons, but it is possible that the occurrence of heavy rainfall is the chief factor which determines the incidence of deterioration.

The appended charts show the variations in the amounts of glucose, sucrose and crystallisable sugar present in windrowed canes; also the rainfall and variation of the mean weekly temperature in the Peshawar valley.

823 - **Trees with Light-Weight Wood Central America.** — ROWLEE, W. W., in *Journal of the New York Botanic Garden*, Vol. XXII, No 256, p 75-78 Lancaster, Pa., April 1921.

During the last 3 years the author has had very favorable opportunities to study light weight woods in the forests and jungles of Central America. Three genera have been selected to illustrate types of light wood, viz. *Ochroma, Cavanillesia* (N. O. Bombaceae) and *Jacaratia* (N. O. Caricaceae).

Ochroma. — " Balsa." In the Tropical Forest Region this attains its largest size and greatest abundance and the trees flower at the age of two or three years. The average growth in diameter under favorable conditions is rapid, nearly 5 inches per year during the juvenile state. The wood ranges in weight from 4 to 12 lb. per cub. ft. The heartwood is homogeneous, silvery white to pink, and the sapwood always white

Cavanillesia. — " Quipo " (Panama) and " Macondo " (N. W. Colombia) and " Barraguda " (Brazil) and Bottle Tree (English). The Panama tree is *C. platanifolia* and attains immense size; the branches and leaves at the very top of the tree and the trunks resemble great columns; the strength of the tree is principally in the thick fibrous bark. The wood is homogeneous, but a large percentage is parenchyma, and is exceedingly fragile in texture.

Jacaratia. — Hitherto considered as confined to South America east of the Andes but in 1920 specimens were found in Panama and Costa Rica. The tree greatly resembles a *Ceiba;* the fruit is characteristic of the Papayas; the wood is soft and spongy. After a portion of the bark is cut away a machete could be pushed in to the centre of the tree with comparative ease. The wood is laminated and the parenchyma bands are very thick and constitute at least nine-tenths of the mass of wood. When fresh it can be cut into blocks, but when dried shrinks to a mere fraction of its original bulk. It is said that the wood of the S. American trees is poisonous when eaten.

The following concomitant features are associated with light wood trees: —

a) Geographically they are confined principally to the Tropical rainy forest region and to the belt of equatorial calms; *b*) the plants possess a very extensive leaf surface; *c*) thick, fibrous bark characterises most of them; *d*) the wood is white or at least very light in colour

824 - **Researches on the Origin of the Oak.** — HAUCH, L. A., in *Det Forstlige Forsøgsvæsen in Danmark*, Vol. V, Part 3, pp. 195-220, figs. 6. Copenhagen, 1920.

The author reports new observations and data resulting from experiments made by the Danish Committee for forest research and experiment on the influence of the origin of acorns on the oaks which grow from them. As has already been reported (1), these researches are carried out on the experimental estate of Sorø (Seeland) with oaks grown from acorns of Danish, Dutch, Russian, Galician, North Hungarian, Slavonian, Moravian, and Istrian (Montona) origin. The importance of this study lies in the fact that the growth of oaks on a large scale is considered to be the most efficient means of afforestation in Denmark, especially after the fellings made on requisition in the last few years, as well as in another fact, viz., the lack of acorns of such quality that the plants grown from them can thrive in the Danish climate. The great majority of the experimental plots bear plantations 8-12 years old, very close grown, which show clearly the influence of their origin. Experience shows in the first place that it is better not to sow any foreign acorns, since oaks grown from indigenous acorns are stronger and more vigorous than those of exotic origin. Ordinarily the former bear matured shoots with large turgid buds and they only produce a few small shoots in summer, for which reason they are less subject to oïdium. Generally, the exotic oaks are straighter than the Danish; they produce, during the summer, a greater number of long thin shoots with small buds much attacked by oidium and often do not mature.

Another difference between oaks of various origins is the time at which they come into leaf; for example plants produced by acorns imported from Russia, from Selmechànya (Hungary) and from Montona come into leaf earlier than the others. Oaks grown from acorns imported from Holland, Galicia, and Slavonia shoot later than the others. The oaks grown from Danish acorns belong neither to the group which comes into leaf early nor to that which comes into leaf late.

In observing the date when the leaves turn, in autumn, it has always been noticed that the oaks grown from Danish (Hald) acorns turn yellow first whereas those of Dutch origin turn latest. However, regarding this character, in some years (for example in 1918 and 1919), the difference between trees of different origins, is very slight or even *nil*; in other years (as in 1917 for example), it is, on the contrary, very marked. As this phenomenon varies from one year to another it seems to be due to the autumn temperature and to the first frosts being more or less early. A mild autumn, without early frosts, accentuates the difference in tints of the turned leaves between the oaks of Danish origin and the oaks of exotic origin; whereas when the trees have been affected by an early frost the leaves of the oaks of various origins all have a similar colour. The Danish oaks turn in about the same degree whether the autumn is mild or whether there are early frosts. When there are early frosts, the exotic oaks turn like the Danish oaks, but a frostless autumn is favourable to keeping their leaves green. This may influence, in turn, the development of shoots in the following spring and to such an extent that, in the case of exotic oaks which always have in spring many shoots that are not yet mature, several of these shoots may become mature if the autumn is mild.

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(1) See *R.*, 1915, No. 394. (*Ed.*)

Besides these effects of the difference of origin, another fact may be noticed in the experimental plots, namely the influence which the greater or less development of the mother trees may have on the young plants. Thus, among the Danish oaks, the plants in one plot are very vigorous and some of them are higher than all the other Danish plants; the acorns sown in that plot came from well developed old oaks of Bregentved, Boholte. In another plot the growth is fairly vigorous, but the plants are not very high; the acorns from which they grew came from the forest of Heald in Jutland, where the oaks are small but robust. Yet another peculiarity may be noticed in a third plot where the plants are often defective, open and drooping; the acorns from which they grew were gathered at Bregentved from trees with large leaves, much branched and irregular in form. Regarding exotic oaks, a specially luxuriant growth is noticed in those grown from acorns imported from Galicia and Slavonia, where some of the finest oakwoods of Europe are found.

These researches show the important effect of the origin of the seed on the growth of the trees; they also show that oaks grown from exotic acorns are much more sensitive to frost and much more subject to oïdium than those grown from Danish acorns; that, when it is possible to procure Danish acorns and still better acorns from the district where sowing is to be made, it is better to use them only. The author remarks that the available supply of Danish acorns is insufficient to extend the growth of the oaks as much as is desirable so that Denmark is obliged not only to use all the available indigenous acorns but also to import acorns fromabroad.

These researches prove the great importance of knowing the origin of the seed; it would be better to give up planting oak than to use acorns of unknown origin. It is evident that none of the exotic acorns can be used with complete certainly, at least in the colder parts of Denmark; even if, as is the case for certain agricultural plants such as clover and sugar beet, exotic specimens are successful in the warmer parts of the country, in the colder parts thin delicate shoots, which continue to grow until late in the autumn, render the exotic oaks more sensitive to adverse conditions to which oaks grown from Danish acorns do not succumb and under which those grown from local acorns do still better. A difference is, however, noticed between oaks of various exotic origins although it is not advisable to sow acorns from Russia (Poltava), Hungary and Montona (Istria) because they come into leaf early and because they have thin, immature summer shoots in autumn. The sowing of acornsimported from Galicia and Slavonia, which give plants which come into leaf late and whose summer shoots, while abundant are slightly more vigorous and bear mature buds more frequently than the oaks grown from Russian, Hungarian or Istrian acorns, may be tried with less risk.

[824]

825 - **The Possibility of Reproducing Species of Eucalyptus in the Open.** — LEONE, G. (Istituto sperimentale agrario, Tripoli), in *L'Agricoltura coloniale*, Vol. XV, No. 2, pp. 74-78. Florence, Feb. 1921.

From experiments made at the Experimental Agricultural Institute of Tripoli since 1914, it appears that the growth of *Eucalyptus* spp. might render great service in Tripolitania, for these trees do very well under the conditions of soil and climate of that country; even on very poor soils, they can form a powerful wind screen in 3 years and in 10 years they can furnish wood, which is entirely wanting in the country, for many and varied uses.

The species which up to date have proved more particularly suitable and which grow more rapidly are *Eucalyptus resinifera, E. rostrata* and, apparently, also *E. saligna* and *E. rudis*. The two first-named owing to their abundant, close foliage, are excellent for wind screens.

An obstacle to the propagation of this tree on a very large scale lies in the system of reproduction. As a matter of fact, as yet the young plants have only been raised in pots, as it is generally very difficult to get them to take root unless they are transplanted with earth round the roots. The author attempted to raise the plants in the ground in a nursery, sowing being carried out toward the end of winter and transplanting into the open field or on the sand hills at the end of the following winter. The plants were watered when transplanting was done. A few days later the plants lost their leaves almost entirely and appeared to be dead; but after a few months the leaves began to appear again and soon a fine foliage was re-established.

These experiments made with *E. resinifera*, will be continued with similar species, but already some observations indicate that these species will behave similarly.

LIVESTOCK AND BREEDING

826 - **Penetration of the Trypanosome of Dourine** (1) **through Mucosa and Teguments.** — NATTAN-LARRIER, L., in the *Comptes rendus des séances de la Société de Biologie*, Vol. XXXIV, No. 16, p. 824-826. Paris, May 7, 1921.

For the better comparison of the power of penetration of the two trypanosomes *Tr. equiperdum* and *Schizotrypanum cruzi*, the author initiated investigations on mice by means of a fixed virus that is very pathogenic for that animal. He ascertained that, for mice, the conjunctiva, the rectal mucosa, the depilated skin, are penetrated by *Tr. equiperdum*, while they prevent *Schizotrypanum cruzi* from passing. Penetration by *Tr. equiperdum* is not, however, always effected in a constant manner (once in 5 cases for the conjunctiva, once in 3 cases for the rectal mucosa, twice in 2 cases for the depilated skin). The mucosa of the upper digestive

(1) See *R.*, May, 1921, No. 519. (*Ed.*)

organs, which, according to ROUGET is never penetrated by *Tr. equiperdum*, was only penetrated in one of the three mice. *Sch. cruzi* appears to penetrate it more easily.

827 - **Bovine Piroplasmosis in Morocco and its Relationship with the Piroplasmoses of the Mediterranean Basin** (1). — VELU, H. (Vétérinaire Major, Laboratoire de recherches du Service de l'élevage), in the *Bulletin de la Société de Pathologie Exotique* Vol. XIV, No. 2, pp. 116-124. Paris, Feb. 1921.

The author has collected the observations recorded in Morocco during the last ten years and he compared them with other publications relating to piroplasmoses of the Mediterranean basin. From a detailed examination of the observations made up to date in the different countries regarding the symptoms, pathological anatomy, pathogenic agent, diagnosis, experimental inoculation, agent of transmission, the author concludes, in the light of the facts, that circum-Mediterranean piroplasmoses are rarely unmixed diseases and appear generally, to be due to parasitic combinations (*Piroplasma bigeminum-Theileria mutans, Piroplasma bigeminum-Anaplasma marginale, Theileria annulata-Theileria parva*), which conduce to give very diverse clinic types rendering accurate diagnosis a matter of extreme difficulty, even impossible in certain cases. This fact is not peculiar to the Mediterranean basin. The first combination *P. bigeminum-Theileria mutans* is found in a great many countries, but owing to the feeble pathogenicity of *Theileria mutans*, the principal course of the disease is little modified. The type *Theileria parva-Theileria mutans* appears to be the special type in the Mediterranean basin. It is more general but it is not the only type. Thus, on the White Nile BALFOUR has observed *Theileria mutans* associated with *Anaplasma marginale*. In 1916, STEFKO observed in the region of Trebizond, in cattle imported from Russia, mixed infections with *Piroplasma bigeminum, Th. annulata,* and *Anaplasma marginale*. CARDAMITIS found *Theileria mutans* and *P. bigeminum* associated in cattle in Greece. Piriform infections are reported generally in Asia, at Madras, in Japan, Annam, China, at Tsing Tav, and in the Philippines, on the Ivory Coast, at Stanley Pool, at Dahomey, in Queensland, and recently in Morocco, and, at any rate in Morocco, it is possible to differentiate typical piriform piroplasm.

Theileria mutans may cause unmixed infections. It was recognised, in 1911, by MARTOGLIO, STELLA and CARPANO in Erythrea living habitually in Erythrean cattle. PRICOLO, in 1914, observed in cattle from Tunis a piroplasma which was probably *Th. mutans*.

Bovine piroplasmosis in Morocco appears to be an unmixed disease and consequently accurate investigation should be possible on the parasites and intermediate agents, to facilitate the identification of the agent causing the disease and to simplify the complex and important problem of preventive immunisation.

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(1) See *R.*, Jan. 1921, No. 72. (*Ed.*)

828 - Special Facts Relating to Anthrax in Morocco and its Specific Prophylaxis (1). — VELU, H. (Chef du Laboratoire de recherches du Service de l'Elevage. Note read at the meeting of the Central Society of Veterinary Medicine on April 7, 1921), in the *Receuil de Médecine Vétérinaire*, Vol. XCVII, Nos. 8 and 10, pp. 176-180. Paris, April 10, May 30, 1921.

Vaccination against anthrax by the direct use of the second Pasteurian vaccine, which has shown itself very efficacious for pigs, remains quite powerless in infected herds of cattle and flocks of sheep and goats in which it has constantly proved ineffective in keeping down mortality. Without fully explaining all the peculiarities, several causes very certainly contribute to give anthrax, in Morocco, an aspect slightly different from that which is commonly seen in Europe. Such causes are overwork, privation, the length of the dangerous season and the extreme dissemination of contagion. Now, two other points require special attention:— 1) *The inefficacy of hte serum in cattle, sheep and goats ;* 2) *the peculiar virulence* of *the bacteridia.*

Regarding the inefficacy of the serum the author remarks that subcutaneous injections in prescribed doses in non-feverish animals (10 cc. for cattle and 5 cc. for sheep and pigs) are perhaps insufficient for cattle, sheep and goats on account of the peculiar circumstance that anthrax, in these species, is always a general infection which develops very rapidly (1) while in pigs anthrax is primarily a local affection (glossanthrax, garothilla).

Quoting the work of BORDET as support, the author considers that it should perhaps be possible to remedy this by using, on all the infected animals, even the feverish ones, intra-venous injection repeated on several successive days of high doses (20,40 and 50 cc.) recommended for the feverish animals by the Pasteur Institute.

The peculiar virulence of the bacteridia should also be regarded as one of the possible reasons for failure. LHÉRITIER, FLEURY, and TRIBOUT have previously (2) shown that in North Africa there is a race of bacteridia adapted to the organism of North African sheep and more dangerous for them than the French bacteria.

The new campaign should show whether the use of the third vaccine furnished by the Pasteur Institute will give greater or longer immunity. Besides there is the question whether the inefficacy of the serum can be remedied by the constant use of larger doses and by intravenous injection and, if these methods prove insufficient, by using as bases in the preparation of various serums, different types of microbes isolated from animals which have died of anthrax in Morocco.

829 - Haemo-prevention and Haemo-vaccination against Foot and Mouth Disease (3) — VALLÉE, H., and CARRÉ, in the *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 23, pp. 1449-1452. Paris, June 6, 1921.

The specific properties of the blood of cattle cured of foot and mouth disease were brought to notice many years ago by LÖFFLER and FROSCH,

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(1) See *R.*, May, 1920, No. 543. (*Ed.*)

(2) LHÉRITIER, A., FLEURY, A., and TRIBOUT, A., Moutons algériens et bactéridie charbonneuse (Algerian sheep and anthrax bacteridia), in *Bulletin de la Société centrale de médecine vétérinaire*, Oct. 30, 1921, p. 513. (*Author's note*).

(3) See *R.* March 1920, No. 335; *R.* Sept. 1920 No. 882; *R.* March 1921 Nos. 308 and 309. (*Ed.*)

Perroncito, Roux, Nocard, Carré and Vallée. Owing to the impossibility of obtaining serums that are efficacious against foot and mouth disease in sufficient quantity many authors were quite naturally led to utilise, as a remedy against this dreadful disease, the blood or the serum of animals which had been cured (Perroncito, Kuypers, Beijers, Broersma, Aukema, Lebailly, Desliens, etc.).

The results obtained by the various writers being far from agreeing, the present authors have renewed the study of the question and now express a decided opinion on the value of the method and the conditions of its use. It is briefly summed up as follows: —

I. — Just like experimental producers of various therapeutic serums, cattle cured of foot and mouth disease do not all furnish, in equal conditions of infection, equally active serums.

It is therefore necessary, with the object of regularising the results of haemotherapy, to use as much as possible a homogeneous mixture of citrated blood taken from a whole groups of animals from the 12th to the 15th day after the appearance of the vescicular eruption. In no case would blood drawn from a single convalescent be used, no matter how severe its attack had been. It is also necessary, when estimating the severity of the progress of the disease in a sick animal, not to confuse the effects of the disease itself and the effect of various complications attending the injuries caused by the issue of the virus.

II. — By the addition of an antiseptic, citrated blood can be kept in a refrigeration at +1° C. for at least 3 months without losing any of its useful qualities

III. — In any case the dose used, no matter what species of animal is treated, should not be less than 1 cc. of serum per kg. of live weight of the animal to be immunised (1).

IV. — The conditions specified above being complied with, injections of citrated serum from cured animals prove to be very regularly provided with all preventive qualities, which enable animals treated with them to resist both natural infection and subcutaneous inoculation of large doses of foot and mouth disease virus (virulent lymph, $^1/_{20}$ cc.; virulent blood, 5 cc. and 10 cc.).

V. — The duration of the immunity conferred does not exceed 15 days in most cases. It can be prolonged for similar periods by means of a 2nd or 3rd injection under the same conditions as the first.

VI. — Only animals free from the disease at the time of the preventive injection are immunised. Made during incubation of the disease, injection of the serum of cured animals in no way hinders the course of the disease, which, however, takes a milder form. However profitable the practical use of haemoprevention may be, especially for the infallible preservation of young animals, it remains of limited interest regarding the benefit which may be expected from a method capable of conferring a longer duration of resistance on the animals to be protected.

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(1) The authors previously noted, in 1903, that the effective dose of serum taken from cured animals varied between 500 and 1000 cc. (*Revue générale de Médecine vétérinaire*, Vol. 1, 1903, p. 372). (*Authors' note*)

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The attempts made with this object by LÖFFLER, NOCARD, ROUX and by the authors are well known. Most of them tend to experiments of sero-vaccination

The authors have continued their researches in this sense by using blood from cured animals in various combinations with aphthous virus, either in the form of aphthous lymphs or powdered epithelium filtered through a porcelain filter, or preferably, by defibrinated virulent blood.

Under the protection of an injection of blood of cured animals made under the conditions detailed above, cattle and sheep may safely be inoculated with doses of from 1 to 10 cc. of virulent blood either at the time of inoculation with preventive serum or 5 days later. Animals so treated resist infection and go through the whole of an epidemic without contracting the disease

Experiments in progress will determine:— The duration of immunity thus conferred; its value with regard to aphthous virus of various breeds or action; whether preference should be given to the simultaneous inoculation with the serum of cured animals and of virus or to successive inoculations of one or the other.

830 - **New Method of Ascertaining Gestation by Galvanometric Registration of the Heart Beats of the Foetus. Experiments in Germany.** — NORR, J (Physiologisches Institut und Poliklinik fur grosse Haustiere der Tierarztlichen Hochschule Berlin), in the *Berliner Tierarztliche Wochenschrift*, Year XXXVII, No 1, pp 1-6, and No 2, pp 17-20 Berlin, Jan 1921

Experiments made with cows, goats and mares. The first-named being fidgety and restless, trustworthy results could only be obtained with the mares. Some very useful curves were successfully registered. The places of derivation chosen were the oblique portion of the *ilio-pelvic colon* and the *Regio umbilicalis* or the *Regio iliaca dextra et sinistra.*

Hollow silver electrodes were used for rectal derivation and for epidermal derivation, plates of zinc amalgam which were pressed on the hair well moistened with zinc sulphate. The reception and registration of the heart beats of the foetus were made with the "Siemens und Halske Elektrocardiograph". The advantages of the method are as follows:— 1) Graphic registration eliminating all possibility of errors; 2) derivation from the *Regio umbilicalis* or from the *Regio iliaca dextra et sinistra* is simple and convenient, rendering possible the ascertaining of gestation without injury to the vagina; 3) the result of galvanometric auscultation is legible in a few minutes on the ground glass of the apparatus; 4) the graphs registered can be used as documents in trade.

831 - **On Sanson's Avenine.** — BROCQ-ROUSSEAU, and THOMAS, P. T, in the *Recueil de Medecine Vétérinaire*, Vol XCVII, Nos 8 and 10, pp. 212-218. Paris, April 30-May 30, 1921.

After a critical examination of SANSON's various papers on the supposed alkaloid body in oats called avenine, the authors relate their unsuccessful attempts to prepare this alkaloid by following SANSON's directions. Using a different method by treating 1 kg. of oat pericarps with alcohol at 80° C. in the presence of tartaric acid and subsequent treatment of the viscous extract until a light yellow residue which does not crystallise was extracted, the authors have shown that there was no alkaloid. This residue, redissolved in water has the following characters :— With alkaloid reagents, iodine in potassium iodide solution, iodo-mercurate of potassium, etc., there was no precipitate. The substance obtained is therefore not an alkaloid. Other reagents (Millon's reagent, ferric chloride, Fehling's reagent, ammoniated silver nitrate, vanilline, and hydrochloric acid) seem to indicate the characters of a polyphenol or of a tannin of the phloroglucic group.

The authors conclude that in any case there can be no question of an alkaloid, especially of a substance having the properties described by SANSON. SANSON's avenine therefore does not exist, or at least that writer must have designated under that name a non-alkaloidal substance or a mixture of non-alkaloidal substances, on the physiological properties of which it is necessary to make distinct reservations.

832 - **Dutch Researches on the Colour and Markings of the Coats of Cattle.** — KUIPER, K, jr., in *Genetica*, Vol. II, Part 2, pp. 137-161. 'S-Gravenhage, March, 1920

The author, after an account of the work of other investigators on crossing cattle (1), gives the results of his own experiments. Experiments of this kind, owing to their heavy cost, are always defective, especially considering that the information furnished by owners has always to be more or less depended on, and this the author also has made use of so far as it was authentic It was a case of the cross between cattle of the " Lakenvelder " breed (Dutch Belted Cattle) with Dutch black piebald cattle (sometimes black and sometimes white predominating).

The " Lakenvelder " breed is distinguished from the very variable black piebald breed by the regular distribution of black and white, that is to say the front third and the hind third of the body are black while the intermediate third is white, so that the cattle look as if they were covered with a white blanket. A " Lakenvelder " bull, whose pedigree was known from the Herd Book was used to serve a considerable number of black piebald and red piebald cows, in which the black and the red were very irregularly distributed and most of which had completely black or red backs and white bellies and extremities. The calves resulting from this cross were divided up as follows :— 27 " Lakenvelder," 24-25 black and 3-4 black piebald.

All the animals with a white band round the body were considered as " Lakenvelder " while the animals which had only insignificant white markings were counted as pure black

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(1) WILSON, James, Mendelian Characters among Shorthorn Cattle. *Sci Proc. R. Dubl. Soc*, Vol. XI, N. S, No 28, 1918. — See also *R.*, Jan. 1920, No 81 (*Ed.*)

Cows of a pure "Lakenvelder" line served by the same bull (*A*), gave birth to 1 black bull calf, 2 "Lakenvelder" bull calves (perfect marking) and 2 heifer calves with slightly irregular coats. Another "Lakenvelder" bull (*B*) bred with the same cows 2 "Lakenvelder" reds with white extremities and 1 "Lakenvelder black (very irregular markings). It follows that plain coloured as well as very different calves may be produced. Red did not appear in the crossings with the bull (*A*) which is homozygous for black. It may also be remarked that, in the calves, produced by cows with white foreheads (" blaarkap "), the character "white forehead" was dominant to the character " black head " (" zwartkop ") of the bull, as is shown by the genealogical Table below :—

Bl = white forehead, **bl** = black head

F_1 white forehead (**Bl bl**) × Jaap (Lakv. ♂) **bl** × Hanna (**bl**).

F_1 Lakenv. white forehead (**Bl bl**) × Kees ♂ (**blbl**) = Else v. Dam (**blbl**)

F_2. . . . . .Lakenv (**blbl**) = Adrian Leer (**blbl**).

F_3. . . . . .black calf (**blbl**)

According to other researches the plain colour (red-brown or black) of calves in a line of "Lakenvelder" thorough breds is fairly common, So that that breed must possess a factor " plain colour ,, that is hypostatic with regard to the factor "Lakenvalder." The latter factor, moreover, is independent of colour, of the factor " spots " (vlekfactor ") and of the factor " white forehead." In the cross between piebald cattle × " Lakenvelder," the same types appeared as in the above-mentioned cross, namely :— " Lakenvelder " black and piebald, but in another numerical proportion which is caused by the more pronounced genotypic difference of the " Lakenvelder " cows. The proportion was 2 black, 1 piebald and 18 " Laken velder of which 12 were with much too wide blankets. The pattern of the spots is hypostatic in relation to the pattern of the blanket. The bull (*A*) is no doubt heterozygous for the pattern of the blanket. In the latter cross the " Lakenvelder " type seems to be more strongly influenced by the factor " piebald." The appearance of three types "Lakenvelder," piebald, and plain colours (black or red brown) may be explained as follows :— When L represents the factor for the pattern of the blanket, l its absence, E the factor for plain colour, e its absence shown by the appearance of spots, the formula for " Lakenvelder " cattle is $L\,l\,E\,e$, while the animals with a defective pattern would have the formula $L\,L\,e\,e$ or $L\,l\,e\,e$. L is epistatic on E. The ratio black : piebald in the blanket, 24 or 25 : 4 or 3 closely agrees with the ratio noticed in the repulsion of factors according to the series of reduplication :— 1 : 7 : 7 : 1 We have therefore 1 $L\,l\,E\,e$: 7 $L\,l\,e\,e$: 7 $l\,l\,E\,e$: 1 $l\,l\,e\,e$.

Calculated on 55 descendents the result would be :— $^{55}/_{16} \times 8 = 27\frac{1}{2}$ " Lakenvelder," $^{55}/_{16} \times 7 = 24\,^{1}/_{16}$ plain colour, $^{55}/_{16} \times 1 = {}^{55}/_{16}$ piebald. All these data may be explained as follows :— There is close correlation between white extremities and too wide blankets.

833 - **Note on a Herd of Albino Cattle in Minnesota, U. S. A.** — DETLEFSEN, Y. A (College of Agriculture, University of Illinois, Urbana), in the *Journal of Heredity*, Vol XI, No 8, p 378-379 Washington, Nov.-Dec. 1920.

The "albino" character appeared in two calves (one male and one female) of a cross between pure Holstein × half bred unrelated grade Holstein. The young bull of the F_1 generation crossed with ordinary Holstein cows behaved as a dominant homozygote. Thus, mated with half-bred unrelated grade Holstein cows, only albinos to the number of about 20 were bred. Four albino cows served by a registered Holstein bull gave birth to 3 albino calves and 1 ordinary calf.

The animals had pronounced albino characters. With one exception, pigmentation of the coat, eyes, horns and hoofs was entirely lacking.

No correlation between the character "albino" and good milk-producing qualities was noticed.

834 - **Purely Somatic Change of the Character "Blue Plumage" with the Character "White Plumage" in an Andalusian Hen, Observed in the United States.** — LIPPINCOT, W A., in *The Journal of Heredity*, Vol IX, No 8, pp 312-317 Washington, Nov - Dec. 1920

A Blue Andalusian hen aged 2 years in the spring of 1917, belonging to a pure pedigree line, produced during the moulting season in October of the same year, white neck feathers and a little later primary wing feathers which were also white, while normal blue feathers appeared on other portions of the body. In the following July, when the hen was moulting, all the old blue and white feathers were replaced by white feathers. Six week later the hen had pure white plumage.

The author has searched the literature but has not come across a similar case. Previously in 1918 (1), he had shown that generally the genetic constitution of Blue Andalusians was the following: — **PP (Re) (rE)**.

P represents the factor for the formation of black pigment, while its allelomorph produces a dominant white. **R** is a dominant factor which hinders the diffusion of the pigment black, thus producing a characteristic slate-blue colour. The factor **E** causes the plain colour of individuals having the factor **P**. The combined action of the factors **R** and **E** on the black pigment produces the character plain blue. According to previous researches it seems reasonable to admit that each of the factors **R** and **E** is closely, perhaps even completely, linked to the allelomorph of the other

The author further quotes the work of BATESON and PUNNETT (2), who have shown that in-breeding produces blacks, blues and speckled in the ratio 1 : 2 · 1. During the years 1917-1920 inclusive, the author continued his experiments with the hen in question, mating her successively with: — 1) A Blue Andalusian cock; 2) a white Wyandotte cock

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(1) LIPPINCOT, W. A, 1918, The case of the Blue Andalusian. *Amer. Nat*, 52, 95-115 (*Author's Note*).

(2) BATESON W, and PUNNETT R. C., 1906. Reports to the Evolution Committee of the Royal Society, III, pp 11-23 (*Author's Note*).

(genetic constitution ***pp* (*rE*) (*rE*)**; 3) a White Plymouth Rock cock; 4) another white Wyandotte cock (heterozygous for **I P** [inhibitory of pigment], factor for white dominant).

The composition of the young with regard to the character " plumage " was as follows:—

1) — 5 chicks, of which 1 blue spotted with white and 4 blue
2) — 28 » » 13 blue and 15 black
3) — 25 » » 7 blue and 18 black
4) — 9 » » 5 blue and 4 black.

The results clearly show that the new character " white plumage " was not hereditary and that the hen transmitted to her descendants the character " blue plumage " like any normal hen of the Blue Andalusian breed.

835 - **On the Belgian Draught-horse.** — RASQUIN, M., in the *Journal de la Société Nationale des Agriculteurs de Belgique*, Year III, No. 26, pp. 201-203. Brussels, June, 1921.

The XXXIInd national show of stud horses, organised by the Royal Society " Le Cheval de Trait Belge," has proved that marked progress has been made regarding the relationship between the size of the horses and their skeleton.

While in 1880 a horse with a canon bone measuring 25 cm. was a phenomenon, at the present day it is common for stallions to measure 27 to 28 cm.; some even measure more and mares measure 25 to 26 cm. In future, the maximum being reached, the further consolidation of the skeleton should be sought after to maintain the ideal type obtained. Further, this last show has proved that the homogeneity of the breed continues in good conditions and, moreover, that the Belgian horse has a well defined origin, of which " Jupiter " was the pre-eminent founder. Thus the blood of that thoroughbred is in more than 80 % of the horses shown. The champion stallion as well as the champion mare trace descent from " Jupiter."

A considerable evolution in coat may be noted. At the show in 1880, out of a total of 625 horses shown, 44.1 % were bays, 13.4 % chestnut, 6.5 % blacks, 17 % greys, 13.1 % roans and 5.4 % flea-bitten greys.

In 1904, the percentages were as follows: — 43.65 bays, 35.4 chestnuts, 3.38 blacks, 5 greys, 8.8 roans and 3.7 % flea-bitten greys. At the 1921 show the percentage of chestnut horses had still further increased; 41 % of bays, 48 % of chestnuts, 8 % of flea-bitten greys and roans, 3 % of blacks and greys were recorded. The following are the percentages of prizes awarded to the different coats:— Bays, 35 % chestnuts, 54 % flea-bitten greys and roans, 9 %, blacks, 2 %. Blacks and flea-bitten greys and roans are therefore giving place to chestnuts and bays, which are the dominant coats of the Belgian heavy draught-horse.

836 - **The Verification of Herd Books by means of Statistics of Variations.** — FEIGE, E., in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, No. 16, pp. 161-163. Hanover, April 1921.

Herd Books, indisputable indicators of the real conditions of breeding, furnish specially accurate bases for the scientific and practical evaluation of breeds, subject to the condition that the measurements recorded in the Herd Books are accurate. The author has studied the data in one of the best known German Herd Books, from the standpoint of the statistics of variations, and has brought to notice some results contrary to all mathematical rules. He investigated the information given in the Herd Book in question concerning the length of body, width of the pelvis, depth of the chest, and the height at the withers, and he proves by the method explained below (1) that no body measurement had been registered less than the initial measurements recorded in the text, that is to say, that when measurements smaller than the initial measurements were made, the figures

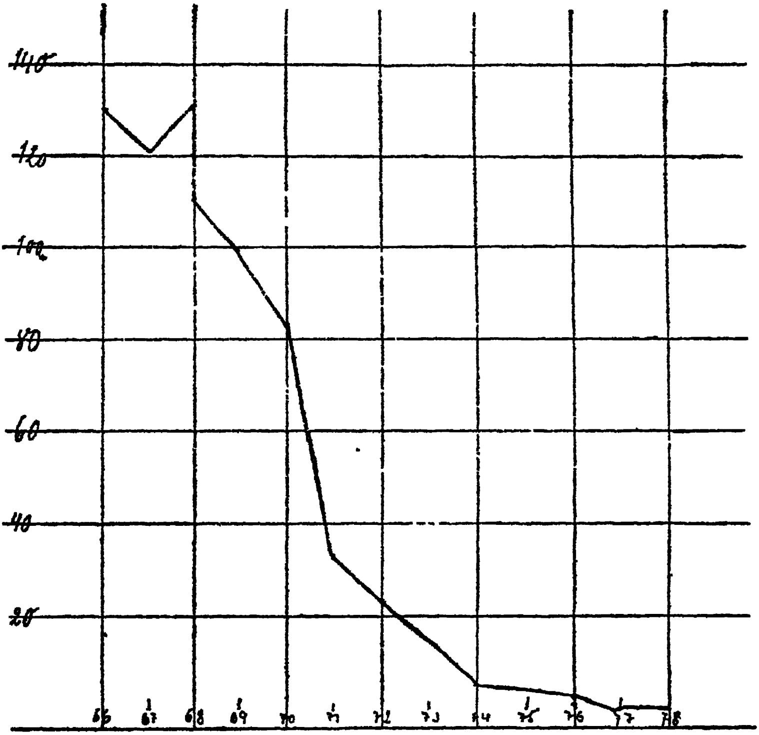

Diagram showing the method of correction.

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(1) ZORN, W., Die Anwendung des Ausgleichsrechnung und Variationsstatistik auf Rindermessungen usw. *Mitteilungen der Landw. Institute der Universität Breslau*, Vol. VI, Part. 4.

were increased. The method used for proving correction is the following :— All the individual measurements are entered in a table in order of magnitude, and then shown graphically by a curve of variations.

A curve of ideal variations would result when any measurement, length of body for example, is grouped very regularly round an average value (M) in such a way that the nearest measurements to that average value were most frequently represented; hence cumulation of variants round the average value and gradual decrease in two opposite directions from the average corresponding to the binomial formula $(a + b)^n$. Now, in practice, an ideal arrangement will very rarely result, owing to variations due to the kind of life and heredity of the animals; on the contrary several average values may be noticed round which the variations are grouped and when this is not the case in a series of observations some alterations must be admitted.

The limits of variability are found by means of the typical deviation (σ). Practically the average value + or — of the typical triple deviation represents the limit of variations; beyond $M \pm 3\,\sigma$ no measurements are found except in very large series of observations.

Thus the figures for the depth of chest gave, for 644 cows, the following distribution :— (The upper series of figures indicates the class of magnitudes and the lower series the number of cows).

65.5 — 66.5 — 67.5 — 68.5 — 69.5 — 70.5 — 71.5 — 72.5 — 73.5 — 74.5 — 75.5 — 76.5 — 77.5 — 78.5
130 121 131 99 83 33 23 15 5 — 2 1 1

For depth of chest the average value 68.5 cm. and a typical deviation of + 4.181 cm. result, so that the range of variation is $M \pm 3\,\sigma = 81.043$ to 55.96 cm. Some cows should therefore be found corresponding approximately to these limits. In fact above the average (68 cm.) the range is almost reached, whereas, below the average there is a very remarkable lack of continuity, as the limit of negative variations is 55.96 cm. and the series stops at the 66 cm. classes of magnitude (130 cows). Nevertheless the series corresponds with the binomial arrangement because the cows, of classes lower than 66 cm. have not been omitted although the value of the numbers has simply been corrected. The author remarks that the figures having been taken without selection from the mass of data the results can scarcely be contingent.

The diagram given above also shows very dearly the method of correction. The arrangement is almost ideal, but the curve is defective as its left side is completely suppressed. Small measurements are entirely wanting. The peak of the curve is at 68 cm. (average value); after passing the 67 cm. class of magnitude the curve rises steeply to reach a culminating point at 66 cm.; below this limit no animal is found belonging to a lower class. In the classes above 68 cm. (131 cows) are found 99 + 83 + 33 + 23 + 15 + 5 + 2 + 1 + 1, a total of 262 cows while belows the central class 121 + 130 = 251 cows are found. The figures for positive and negative variations are therefore in good agreement. It follows that all negative variations have been recorded, but with altered measurements which appear in the 66 cm. class of magnitude.

837 – Herd Books of French Breeds of Cattle. — MESLAY (Report of the Bureau of cattle improvement), in the *Bulletin de la Société des Agriculteurs de France, Comptes rendus de l'Assemblée Générale de* 1921, meeting of March 9 (fifty second session), Part 2, pp. 44-46. Paris, 1921.

MESLAY emphasises the great services rendered by Pedigree Books (1) and Herd Books in showing the way to improve French breeds of cattle (much sought after by foreign breeders and notes that there are still too few of these Books in France. For the 30 or 35 breeds of cattle there are scarcely 15 Herd Books, of which only 8 or 10 are fully successful; the others are embryonic or in course of formation. Nevertheless the inquiry made by the Bureau of Cattle Improvement shows that a certain amount of progress is being made generally; besides some very good Herd Books some of which have already been 35 years or more in existence, others of more recent date are not less successful.

The different Herd Books regarding which the Bureau has obtained information are the following :– 1) The Herd Book of the *Montbéliarde breed.* 2) The Herd Book of the *Limousine breed.* 3) The Herd Book of the *Charolaise breed* of the Nièvre, Saône-et-Loire and affiliated Departments, fusion of two Pedigree Books of the Nièvre and Saône-et-Loire comprising a total of about 11000 entries of cows and heifers and about 5000 bulls. 4) The Herd Book of the *Normandy breed of cattle* (2), a most successful collection comprising 18 000 to 20 000 entries of bulls, cows, and heifers. 5) The Herd Book of the continental *Jersey breed.* 6) The Herd Book of the *Parthenaise breed* with a family or sub-breed, called Maraichine, very good milkers and very hardy, for which a Herd Book has not yet been compiled. 7) The Herd Book of the *Garonnaise breed.* 8) The Herd Book of the *Bazadaise breed.* 9) The Herd Book of the *Maine-Anjac breed* comprising 1500 members and which has entries of about 8 000 animals. 10) The Herd Book of the *Black Piebald Breton breed of Finistère and Morbihan.* 11) The Herd Book of the *Armoricaine breed*, across between the Black Piebald: and Durham breeds, with entries of 713 animals. 12) The Herd Book of the *Red Piebald Breton breed*, very clearly distinguished from the two last. 13) The Herd Book of the *Pyrenean breed* of the South-West with pink *mucosae.* 14) The Herd Book of the *Tarentaise breed*, in process of compilation. Besides these different Herd-Books, there are a great number of breeding syndicates created before the war and other small Communal Societies with bull owners. It would be desirable that these breeding Syndicates should first endeavour to maintain pure breeds in the districts where these exist, and then to compile for each of the breeds a Pedigree Book or a Herd Book.

838 – Note on Rearing " Minor Breeds " and " Local Breeds " of Cattle in Great Britain. — *Live Stock Journal*, Vol. XCIII, No. 2458, p. 455. London, May 13, 1921.

Since the end of the war, the rearing of " minor breeds " and " local breeds " of cattle has become popular in Great Britain. In particular the rearing of the three most important of the local breeds, Sussex, Red Poll and South Devon has extended considerably, but the keeping of Blue Albinos and Old Gloucester, in Derbyshire and Gloucestershire respectively, has also been revived. Small local breeds, valued specially on account of their adaptability, are preferred in their native districts to any other breed, and it is chiefly for that quality that these breeds are beginning to be imported into other districts of Great Britain where the conditions are similar to those of their native district.

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(1) See *R.*, Sept. 1920, N. 888 (*Ed.*) — (2) See *R.*, Sept. 1920, N. 838 (*Ed.*)

Sussex cattle, besides their quality as plough cattle, are specially valued as good beef producers with very early maturity. The half-breed produce of the North Devon (also pure red) × Sussex cross is an ideal butcher's beast, profitable to rear, in which the Sussex gives early maturity and the North Devon high quality of meat.

The South Devon had a certain resemblance, a few years ago, to the Sussex, both being red in colour and both being of large size ; on the other hand the South Devons were lacking in symmetry and were very uneven in flesh.

At the present time the improved South Devons may be considered as one of the most important dual-purpose breeds (milking and fattening properties). The bullocks grow to a great size and have good feeding propensities. Further, this breed is perfectly suitable for crossing with small breeds in order to get increased size and weight. There is no doubt that when the qualities of the South Devon become better known the rearing of this breed with still further increase; the cows not only give large quantities of milk but also the milk is rich in quality.

The Red Poll breed of East Anglia, also a dual-purpose breed, is one of the best dairy breeds. Moreover, there is no doubt that Red Polls can thrive under conditions under which a good many other English breeds would not be able to live. Classed a few years ago among the minor breeds, the Red Poll ought now be placed among the major breeds, but as one of the local breeds.

Similar remarks as those regarding cattle might be made regarding pigs. The Gloucester Spots, the Wessex Saddlebacks and the Essex especially have increased considerably but without in any way diminishing the influence of the major breeds such as the Large Blacks, Berkshires, Large and Middle Whites, etc.

839 - **Experiments in Great Britain on the Effect of Feeding Concentrates either as Warm Mashes or Dry, and of the Percentage of Succulent Foods in the Ration, on the Production of Milk.** — BERRY, R. A (Professor of Agricultural Chemistry, West of Scotland College of Agriculture, Glasgow), in *The Journal of Agricultural Science*, Vol. XI, Part 1, pp. 78-98, graphs 6, tab. 4. London, Jan. 1921.

Experiments carried out at the College Experimental Station at Kilmarnock, Scotland, with Ayrshire cows. Conditions which might influence milk production, such as the health and appetite of the cows and the weather were recorded daily. For each ration figures indicating the content in nutritive material are given.

INFLUENCE OF CONCENTRATES FED EITHER DRY OR AS WARM MASHES ON THE MILK PRODUCTION. — During the three weeks preceding the experiments one half of the meals was fed dry in the morning and the remainder as mashes in the evening. For the mashes the concentrates were mixed, scalded with boiling water (½ gallon to 9 lb. of the mixed meals) and 1 oz. of rocksalt was added.

The mixture was fed in a sloppy condition at the body temperature. As short-period experiments (5 weeks) evidenced the beneficial effect of the concentrates fed as mashes on the milk production, experiments lasting 17 weeks were proceeded with, using 10 cows divided into two groups, and taking into account their period of lactation, milk production, etc. During the first period of the experiment, lasting 5 weeks, the cows in group I were given the concentrates dry and during the subsequent periods, lasting respectively 10 and 2 weeks, the concentrates were fed alternately wet and dry. The cows in group II commenced with the concentrates fed as mashes during the first period and during the subsequent periods the concentrates were fed alternately dry and wet.

The daily ration per cow was composed of:— Turnips 30 lb., hay 7 lb., oat straw 10 lb., bean meal 3 ½ lb., crushed oats 3 ½ lb., decorticated cotton cake 2 lb. The cows were watered once a day for 30 minutes at a trough in the yard and drank an average of 5.7 gallons and 4.6 gallons respectively per head for groups I and II.

The quantity of milk produced by feeding the concentrates as mashes was greater by about 1 lb. per head per day than the quantity produced by feeding the concentrates dry. The increase diminished with the advance in lactation. The warm mashes produced a distinct laxative effect and were more readily eaten than the dry meals. It was noticed that the cows fed on rations containing the concentrates in a dry state lost the good condition of their coats. With a change back to rations containing the concentrates in a wet state or when water was readily obtainable in the byre, the animals recovered the normal condition of their coats. An increased water supply did not appear to have any effect on milk production.

In another experiment carried out in similar conditions to the former, except that the ration was modified, the periods reduced and that the cows were given water *ad lib.*, it was ascertained that for the production of 1 lb. of milk an average of 3.5 lb. of water (drinking water + water contained in the food) was consumed when the cows were fed with a normal winter ration containing 30 lb. of turnips and part of the concentrates given as wet mashes. The ratio of water consumed varied with individual cows, with the preparation of the food (concentrates wet or dry), the proportion of fodder in the ration, the period of lactation of the cows, and the temperature. For 1 lb. of dry matter in the food 3.6 lb. of water was consumed. The total quantity of water consumed per day (drinking water + water contained in the food) amounted to about 10 gallons, of which 50 to 60 % was drinking water; from 25 to 30 % of the total water consumed was contained in the milk.

[839]

INFLUENCE OF THE QUANTITY OF SUCCULENT FOOD (ROOTS) CONTAINED IN THE RATION ON THE YIELD AND FAT CONTENT OF THE MILK. — Experiments in which the quantity of water necessary for the animals was furnished respectively by feeding with succulent food (swedes) and by feeding with rations in which part of the water was taken as drinking water (1).

The experiments were made with 7 cows which during the first period of the experiment were given 112 lb. of roots in their ration. During the subsequent periods 56 lb. and 22 lb. respectively, of roots were replaced by concentrates and fodder so as to maintain the same weight of proteins, fats and carbohydrates in the ration. The daily ration per cow was the following:— Turnips 112 lb., hay 5 lb., oat straw 12 lb., mixed concentrates 7 lb. (bean meal, earthnut cake, crushed outs, bran and fish meal). One half of the concentrated was fed dry and the remainder in a sloppy condition.

Experimental data collected for the various periods.

	January	February				March				
	28	4	11	18	25	3	1		24	31
Average daily milk yield lb.	30.3	29.1	28.7	27.2	26.3	25.2	25	25 0	24.8	24.0
Total solids . . . . . . %	12.69	12.91	12.72	12. 8	13.21	13 4	13 53	13.62	13 31	13.45
Fat weight . . . . . . lb.	1.03	1.06	1.00	0.99	1.02	1.04	1.12	1.13	1.01	1.08
Solids not fat . . . . . lb.	2.83	2.70	2.65	2.49	2.45	2.34	2.32	2.29	2.24	2.16
Total solids . . . . . . lb	3.86	3 76	3.65	3.58	3.47	3.38	3.44	3.42	3.34	3.24
Roots . . . . lb		112					56		90	

A heavy root ration (112 lb.) had a strong purgative effect which adversely affected the health and general condition of the animals. The milk yield, which had shown a tendency to increase at first, definitely decreased later. Although there was an increased percentage of fat, the weight of fat produced diminished. The fall in milk yield was partly, but not immediately, arrested by a change to a moderate root ration. As a consequence there was a decided increase in the percentage and total yield of fat. The consumption of water (drinking water + water contained in the food) per 1 lb. of dry matter amounted to 3.9 lb. with a ration containing 112 lb. of roots and to 3.3 lb. with the moderate root ration. Some of the cows fed with the heavy root ration took on an average between 5 and 6 % of the total intake of water in the form of drinking water. The data relating to the influence of the temperature on the milk yield are given in 6 graphs in the text.

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(1) It is the practice in some of the milk-selling farms in the west of Scotland to feed heavy root rations amounting to 1 cwt. of roots per day W. R. DUNSTAN states that over 100 lb. of roots are fed per head per day on some of the farms in Kent. LAUDER and FAGAN found that cows receiving 112 lb. of roots with wet mashes refused drinking water.

See A. LAUDER, and T. M. FAGAN, " The effect of heavy root feeding on the composition and yield of milk " *Bull 26, Edinburgh and East of Scotland Agricultural College*, 1912. (*Author's note*).

[839]

840 - **The Effect Produced Upon Sheep's Wool by Adding " Ovagsolan " (1), a Digestible Preparation of Decomposed Horn, to Rations Poor in Protein. Experiments in Germany.** — LEHMANN (Institute of Animal Physiology of the Berlin Agricultural College , Abstract from a Report made to the Minister of Food and Agriculture, in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, No. 15, pp. 157-158. Hanover, April, 1921.

Careful experiments made at the Institute of Animal Physiology of the Berlin Agricultural College. These results were at variance with those previously obtained when this preparation was given with much success to two-year old sheep (" Zeitschafe "), and the author could not detect any effect that could be attributed with certainty to " Ovagsolan." Usually, however, micrometric investigations revealed a considerable thickening of the wool, when this preparation was added to restricted rations containing little protein.

In experiments carried out on the patients of some of the Berlin hospitals, a similar thickening of the hair was observed, though in many cases no effect was produced by the use of " Ovagsolan."

LEHMANN discusses the experiments of HELLDORF (2) made upon 100 sheep of two years of age, and throws some doubt upon the accuracy of this work, comparing the results with the data previously obtained by HENNEBERG. In the experiments of the latter, 50 gm. of protein added to scanty rations produced 3.3 gm. of pure wool, and 0.8 gm. when added to fattening rations. HELLDORF, by giving 50 gm. of " Ovagsolan," obtained an increase of as much as 1.5 gm. per day per head. LEHMANN deduces from this fact that the same effect could be produced by giving the sheep pure digestible protein, instead of " Ovagsolan."

The author, basing his opinion on the experimental data, allows that it is possible, that " Ovagsolan," like protein, may have a stimulating effect upon the formation of wool and hair, but believes that it has no nutritive value, that is to say, it does not supply substances like cystine which are lacking in the ration, but stimulates the follicle, and under the most favourable conditions, may induce greater activity in the latter without increasing the ration. On the other hand the efficacy of this stimulus depends chiefly upon the excitability of the hair or wool follicles, as well as upon the protein content of the rations

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(1) The experiments made by ZUNTZ, who added horn decomposed by chemical action to rations poor in protein, having given satisfactory results, a special preparation containing all the substances necessary for wool formation has been made and sold under the name of " Ovagsolan," See *R.*, June, 1921, N. 656. (*Ed.*)

(2) As control animals, 20 two-year-old sheep were taken having the same quality of wool, and of the same size and weight as the sheep subjected to the experiment. The latter were given for 100 days, in addition to their ordinary ration, 50 gm. of " Ovagsolan " per day and per head, and during this time produced 400 gm. more wool per head. (*Ed.*)

Nevertheless, the author states that on account of the limited number of experiments so far carried out, it is impossible to give a conclusive opinion upon the value of " Ovagsolan " as a sheep food, though he thinks that in the case of a temporary dearth of concentrated feeds, and when there is any fear of the fibre of the wool being too fine, a dose of " Ovagsolan " varying from 25-50 gm. might prove efficacious.

841 - **Fattening Lambs With and Without Shelter (Shelter Versus Open Lot).** — WITHYCOMBE R., and POTTER E. L., in *Oregon Station Bulletin*, No. 175, pp. 1-11. Corvallis, Oregon, September, 1920.

The results of two experiments carried out from 1914 to 1919 with two lots of lambs which were fed for the market. Lot 1 was kept through the winter in an open feed yard, while Lot 2 occupied a similar yard, with the exception that it was provided with a low shelter-shed closed on two sides. The lambs were given lucerne hay *ad libitum*, and a limited grain ration consisting of oats and barley. The animals under shelter made slightly higher gains (0.30 lb. per head per day) than those kept in the open yard, which gained 0.29 lb. The shelter lot required per 100 lb. gain 914.10 lb. of hay and 279.29 lb. grain, whereas the lot in the open pen, ate 944.72 lb. hay and 290.49 lb. grain.

The Bulletin is provided with an appendix giving information on the management of fattening lambs, and a discussion of the feeding costs.

842 - **A Study of the Present Condition of Pig-Breeding in Italy.** — I. Una grande mostra di suini a Bologna. *Il Giornale agrario*, Year III, Nos. 20 and 21. Bologna, May 28, and June 4, 1921. — II. CAMFORI, G. C , *Ibid* , No. 22, June 11, 1921, and No. 24, June 25, 1921. — III. Relazione dell'Esposizione provinciale ed interprovinciale dei Suini, tenuta nel Mercato bestiame di Bologna, il 25-29-30 maggio, 1921. — *L'Agricoltura bolognese*, Vol. VI (New Series), No. 6, pp 52-61, figs. 8. Bologna, June 15, 1921. — IV. PERGOLA, V., Lo stato attuale della suinicoltura italiana, in the *Bassa Corte*, Vol. II, Parts 33-34, pp 770-773, figs. 3. Molassana (Genoa), May 1921 (1).

I — II — II. — Pig breeders from the different regions of north and central Italy were exhibitors at the pig-show held at Bologna from May 28-30, 1921, which made it possible to obtain a very accurate idea of the principal tendencies governing pig-breeding throughout a large part of Italy Thus, it was noticeable that there was a strong inclination to use the black breeds, especially the " Large Black " for improving the breeds, instead of the " Large White " and Middle White Yorkshires that had previously been the favourites. This change was fully justified by the greater hardiness of the " Large Black," its superior resistance to the Italian climate, its marked suitability for mixed farms, and especially by its excellent returns in meat and fat.

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(1) See *R*, July-August, 1920, No. 779; *R*., June, 1921, No. 658. (*Ed.*)

The white breed, when acclimatised in Italy, has however developed a tendency to hardiness, and the pigs, though they are less fat, are stronger, better-proportioned, and move with greater ease

Other breeds less known in Italy, on account of their more recent introduction into the country, were also to be seen at the show such as "Gloucester Old Spots" and "Poland China." The latter is raven-black, and was imported from the United States. It resists fatigue and long journeys very well, and is particularly suited for large farms and grazing-grounds Finally, some very promising specimens of a cross between the "Large White" and "Large Black" breeds were also on view.

When the show was about to be closed, Prof. CUGNINI gave a lecture in which he sketched the lines that should be followed by pig-breeders in Italy, basing his remarks upon the results of the show, the experiments he had made during many years at the Reggio Emilia Royal Depôt for Stock Improvement, and the facts he had observed on his visits to the best pig breeders of the region. Prof. CUGNINI is a staunch partisan of the Yorkshire breed for the purpose of improving the type, for the present pigs are larger, hardier, less flat-nosed, better adapted to grazing than their predecessors, and they always transmit to their progeny the characters of size and early maturity. According to the lecturer, "Large Blacks" and their crosses never attain the size, or the early maturity, of the "Large Whites" and their crosses, although the animals of both breeds, and their hybrids, are excellent in their several ways The Yorkshire pig is particularly valuable in turning to account the waste products of cheese-factories. These products, however, should not be fed to breeding animals, for they depress the nervous system; and fatten the pigs. The best feed for sows is lucerne but this should bot be given exclusively; in order to keep the intestines active, bran and ground lucerne hay should be fed, and an aperient administered every fortnight. It is advisable to include mangolds in the sows' ration during the winter, as these roots encourage milk-secretion (1).

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(1) At a model pig Service-Station, that of GEMINIANI Bros, on the Galanta estate near Imola, of which the products (especially the Gloucester pigs and the crosses between "Large White" and the Romagnole breed) were much noticed at the Bologna Show, the following rations are fed to *sows in farrow*: 30 % beans, 15 % maize, 6 % barley, 4 % oats, 45 % dry fodder; *sucking-pigs* until weaning, that is to say, until they are 70 days old, receive 35 % maize, 15 % barley, 10 % oats, 40 % beans, while *pigs to be fattened* are given 40 % beans, 20 % barley, 20 % oats, 20 % maize If oats are scarce, they are replaced by dry fodder. The rations are fed *ad lib.* to all the animals, which are also alloved to graze at will in the lucerne and clover fields. During the winter, their drinking-water is warmed The piggeries are very well ventilated, and are made of a wooden frame covered with reeds. Out of 15 sows from 100 to 150 young are obtained on an average annually; of these 75 % can be used for improving stock. — A. NEGRI. *Giornale agrario*, Vol. III, No. 16. Bologna, April 30, 1921. (*Ed*)

Of recent years, the number of pigs reared in Italy has greatly increased. Two types of pig-breeding are practised in this country, viz., extensive breeding in wooded pastures (this is very suited to local races of the Iberian type, which, however, thus become very mixed), and intensive breeding on the farms. The latter is best adapted to early-maturing and very thrifty animals, which need not be good walkers. It is a mistake to cross local breeds with larger and earlier-maturing breeds that are weaker and less thrifty; what is necessary in extensive pig-breeding, is the rearing and selection of pure-bred animals. Crossing, however is very useful in intensive breeding. The type of pig that has hitherto been used for this purpose is the Yorkshire; the purest-bred animals of this race in Italy are to be found in Lombardy, while in Emilia, and especially in the Province of Reggio, the largest number of the finest Yorkshires are reared. The "Large Black" and Poland-China breeds have recently been introduced, and appear very promising. The Large White × Large Black cross made by Marquis STANGA has produced splendid animals in the first generation, which are much finer than their parents; it, however, remains to be seen how the subsequent generations turn out.

Of the Italian hybrids used for extensive breeding the Siennese, or "cinta" pig (Large White × Iberian var. Tuscan) is worthy of mention. The animals are of good size, well shaped, and thrifty, but do not yet show the early maturity, fixity of character, and perfection of type that are to be desired.

843 - **The Sericultural Institute at Portici and its Work.** — MORESCHI, B, in *L'Italia agricola*, Year 58, No. 5, pp. 142-144. Piacenza, May 15, 1921.

The Sericultural Institute of Portici (Naples), which is attached to the Royal Agricultural College of that town, was founded, together with other institutes of the same character, by the Law of 1912 relating to the silk-industry (1). It was opened in May, 1916, and was in full working in 1920. During the five-year period 1915-1920, the Director of the Institute was Prof. ACQUA (now Director of the Experimental Sericultural Station at Ascoli Piceno).

The author mentions the work done by Prof. ACQUA, or carried out under his supervision, during his time of office.

In addition to the articles of which abstracts have been given in this *Review* (2), the author mentions a histological study by Mme (Prof.) A. Foà (at the present date Directress of the Portici Sericultural Institute) on the alterations produced in the intestinal epithelium of the silkworm by the disease known as "flacherie"; a study by Mme (Prof.) P. LOMBARDI on the orientation of the cocoon and its possible influence on the laying of the moths; this study proves that there is no such influence, and that the divergent conclusions arrived at by other writers on this subject are to be attributed to the small amount of material used in their experiments); a study by Mme (Dr.) C. DI MAIO (1), describing the manner in which the moths of *Bombyx mori* bore through the cocoons under abnormal conditions; this study shows that the moths can perforate the cocoon equally well, whether their heads are turned to the usual side, or to the opposite one, and that the hole is made with the assistance of the alkaline liquid with which the moths are amply provided; etc.

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(1) See the original Article by Prof. O. BORDIGA: The Crisis in Italian Sericulture and the measures for averting it, in *R.*, Oct. 1914, p. 1263 (*Ed.*)

(2) See *R.* March, 1916, No. 328; *R.* Nov. 1916, No. 1202; *R.* June, 1917, No. 572; *R.* Jan. 1918, No. 70; *R.* Feb. 1918, Nos. 145-196; *R.* March., 1918, No. 327; *R.* June, 1918, No. 673; *R.* Dec. 1918, No. 1342; *R.* May, 1919, No. 589. (*Ed*)

844 - **" Muscardine" (*Botrytis Bassiana*) a Disease attacking Silk-Worms and Other Insects.** — CAMPBELL, C., in *Il Coltivatore*, Year LXVII, No. 9. pp. 266-269. Casale Monferrato, March 30, 1921

During the sericultural season of 1920, there was a serious outbreak of " muscardine " (*Botrytis Bassiana*), in the low valley of the Liri. As the region is very isolated, without railway-stations, and as it is difficult to suppose that the conidia of the fungus had been sent with the silkworm eggs, it must be concluded that the disease was transmitted to the silkworm by other infected insects.

AUDOUIN, in 1836-1837, found that it was possible to inoculate the caterpillars of several Lepidoptera (amongst others those of *Limantria dispar*), with *B. Bassiana*; and in 1838, he observed that the disappearance of the Galerucella of the elm (*G. luteola*) was due to the development of " muscardine " in the pupae.

TURPIN (1836) succeeded in inoculating various caterpillars (*Malacosoma neustria, Pieris crataegi*, etc.) with the fungus, which causes the death of its hosts in 8 to 10 days. More recently (in 1914), PICARD reported that he had found *B. Bassiana*, which he calls *Beauveria Bassiana*, in both the perfect and larval states, of cochylis and eudemis, as well as of the cockchafer.

The author was preparing to study the above-mentioned outbreak of muscardine with the object of determining whether it had been transmitted to the silkworm through the agency of other insects, when GHIRLANDA (2) announced his intention of employing *B. Bassiana* as a means of controlling the processional Bombyx of the pine (*Thaumetopoea* [*Cnetocampa*] *pityocampa*).

The author states that such a proceeding is not advisable, for he is of opinion (though GHIRLANDA does not share his view) that the artificial dissemination of *B. Bassiana* would be a serious danger in districts devoted to sericulture, for in the first place, the conidia of the fungus retain their power of germination, under favourable conditions, for over a year, and when transported by air currents, can find suitable hosts, even where silkworms are absent, in the form of other insects, which when attacked, might be a source of fresh infection. In the second place, the fact that it would be necessary to sow the conidia of *B. Bassiana* in August, in order to control the processional Bombyx of the pine, constitutes a serious danger to the summer and autumn rearings of silkworms.

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(1) An abstract of another study by the same authoress is given in *R.*, Feb. 1916, No 176. (*Ed.*)

(2) See *R*, Oct.-Dec 1919, No 1257. (*Ed.*)

845 - **The Chinchilla Rabbit.** — Castle, W. E, in *Science*, Vol. LIII, No. 1373, pp 387-388. Lancaster, Pa., April 1921.

A considerable interest exists in the breeding of the "Chinchilla" rabbit for its fur, which is of a fine pearl grey colour similar to that of the wild grey rabbit except that:— 1) It contains no yellow, yellow being replaced by white; 2) the black portions are replaced by slaty blue

Apparently, these differences come from a single genetic change, that is to say, from a mutation in the "colour" factor that is less extreme than that which has occurred in the white or albino variety, but affecting the same genetic factor.

If a Chinchilla rabbit is crossed with any of the common colour varieties except white, the "Chinchilla" character, like the "albino" character, behaves as a recessive. If the Chinchilla is crossed with the albino, however, a generation composed entirely of Chinchillas is produced, while in later generations both "Chinchilla" and "albino" young will be found.

These facts indicate the existence of an alternative form or allelomorph of albinism, constituting the fourth allelomorph, albinism, recorded in rabbits. These allelomorphs (in order of decreasing pigmentation) are:— 1) Ordinary pigmentation; 2) Chinchilla; 3) Himalayan albinism; 4) ordinary albinism (snow white). A similar, but not identical, series of allelomorphs was described by Sewall Wright for guineapigs (*Carnegie Institution of Washington*, Publication No. 241, 1916). A homologous albinism to Chinchilla albinism was described by Whiting and King for the rat (*Journal of Experimental Zoology*, Vol. XXVI, 1918).

From an industrial standpoint pelts as large as possible, are desirable, whereas the pelt of the Chinchilla rabbit is relatively small However, it is easy to remedy this defect by crossing pure bred Chinchillas with white Flemish Giants. The F_1 generation will all have the Chinchilla fur and will be in addition intermediate or even larger than intermediate, compared with the parents

By further crossing the half bred Chinchillas with white Flemish, still larger progeny may be obtained, until practically the size of the white Flemish is reached The progeny obtained with this method will be composed of 50 % white and 50 % Chinchilla.

846 - **Canada's Fur Farming Industry** (1). -- Brittain, J. I., Consul General, Winnipeg (Manitoba), in *Commerce Reports*, No. 118, Washington, D C, May 21, 1921.

The raising of wild fur-bearing animals in captivity for their pelts has been carried on in Canada for many years, but it is only within the last few years that fur farming has become an established industry, according to a recently published official report on this subject.

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(1) See *B.* 1911, No. 2851; *R.* 1914, No. 51; 1916, No 94. (*Ed*)

In 1912 and 1913 the Dominion Commissioner of Conservation conducted an exhaustive inquiry into the history and possibilities of fur farming in Canada, and the resulting data published in 1913, stimulated the industry. The fox has proved the most suited to domestication, although success has been attained in a few instances with mink, skunk, raccoons, and Karacule sheep. The earliest record of raising foxes in captivity comes from Prince Edward Island, where they have been raised for the past 40 years.

In 1919 the Dominion Bureau of Statistics began the annual collection of returns of fur farms in Canada. The returns show that 424 fox farms, 3 mink farms, and 2 raccoon farms were in operation in Canada in that year.

The fur-bearing animals on the farms at the end of the year 1919 numbered 8 396, valued at $3 201 388, comprising 7 181 silver foxes, value $3 110 915 ; 852 patch foxes, value $77 058 ; 275 red foxes, value $11 345 ; 1 gray fox, value $150 ; 1 blue fox, value $120 ; 77 mink value $1 685 ; and 9 raccoons, value $115. There were born in captivity, during the year 1919, 5 048 silver, 510 patch, and 174 red foxes, and 40 mink.

The number of silver pelts sold was 2 134, with a total value of $501 973. This gives an average value of $235 per pelt of silver fox. Patchfox pelts sold numbered 319, value $21 526 (average value $67), and red fox 164, value $4 586 (average value $28). One blue fox pelt was sold, value $65 ; 56 mink, value $1 030 ; and 2 raccoons, value $30. The number of pelts sold in 1919 does not correspond with the number of animals killed for pelts, the sales for the year including some pelts carried over from the previous year, while the pelts of some animals, killed in 1919 were not disposed of in that year.

Of the 429 farms reporting in 1919, 244 were operated by individuals 87 by partnerships, and 98 by joint-stock companies.

FARM ENGINEERING

847 - **The Increase in the Price of Agricultural Machinery since 1913 and the Principal Reasons which have caused it.** — SCHWANECKE, H., in *Die Landmaschine*, Year I, Nos. 8 and 9, pp. 141-143 and 157-162, diag. 2 Berlin, March-April, 1921.

Despite the improvements made, agricultural machinery and implements used to be sold, in Germany, before the war at lower prices than other mechanical productions ; the prices used to vary between 0.45 and 0.75 *mark* per kg. for ordinary ploughs and 2.20 to 2.60 *marks* for motor ploughs (Intermediate prices are given in the text). Favourable conditions having ceased during the war, prices increased, at the beginning of 1918, by 15 to 25 %, and still further ot the end of the war, and after the revolution in Germany at the beginning of 1919, to such an extent that in March, 1920, prices were 12 to 20 times what they were before the war. From that date a decrease commenced, but a very small one, and it was arrested in the following autumn.

For this reason and on account of the greatly increased prices of material used for agricultural machinery (lubricating oils 30 fold, leather 40 fold the pre-war prices), as well as on account of the limits imposed on the prices of agricultural produce, farmers avoided more and more the purchase of fresh machinery in spite of their increasing need for it

The cost of producing machinery depends on three factors, viz. cost of raw material wages, general expenses.

The raw materials required for the manufacture of agricultural machinery are metals, wood, leather, and coal. When the revolution broke out in Germany cast iron and hematite had only doubled in price, relatively to the pre-war period; but towards January, 1919, prices increased 4 to 6 fold, in October, 8 to 9 fold, in January 1920, 14 to 20 fold and reached the maximum of 30 fold in May, 1920, to decrease later to 23-24 fold in the following January. Iron bars and sheet iron reached higher prices in spite of control by the Government. Wood leather, and coal also reached maximum prices of 20, 50 and 12-24 times pre-war prices respectively in March 1920. At present there is a decrease and the author, gives details of the variations. The wages of adult local labour varied in 1914 between 2.45 and 3.80 *marks* in the towns and 2.00 to 3.30 *marks* in the country; in 1918, it varied between 2.70 — 5.10 *marks* and 2.00 — 4.15 *marks*, respectively. Since 1919, wages have increased considerably and at the present time have quadrupled in the towns and tripled in the country, compared with 1914, and there is no sign of the increase bring arrested. In addition, the hours of work and the industry of the workmen have decreased, so that in many foundries production has decreased by one half and the labour required to produce 1 kg. of cast iron costs 8 times as much as it used to.

General costs have approximately increased in the same proportion as wages

These are the reasons why the cost of production of agricultural machinery, which is made up of about ⅓ for the cost of raw material, ⅓ for wages and ⅓ or less for general expenses, has reached 8 to 10 times the pre-war cost.

The author summarises in figures and in diagrams the rates of the three factors of the cost of agricultural machinery and the price of such machinery during various periods between 1914 and 1920 and concludes: — 1) That although the price of machinery varies with the three factors of the cost, it does not increase to quite the same extent; 2) that further considerable decreases in the price of agricultural machinery, at short credit, can scarcely be expected (1).

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(1) These remarks may also be applied to other countries besides Germany. In Italy the rise in minerals and metals reached a maximum in April, if not in March, 1920, according to BACHI, and the general index number for all wholesale goods reached 836.30, relatively to 100 in 1901-1905 (Cf. *La Metallurgia italiana*, Year 13, No. 3, p. 122. Milan, March 31, 1921). Also the English *Labour Gazette*, which gives some statistical information regarding the variation of wages, price of raw materials, etc. for 1920, states that for that year the general index number for wholesale goods reached the maximum in March, 1920, while wages continue to increase (Cf. *The Economist*, Vol. 92, No. 4040, p. 162. London, Jan. 29, 1921)

848 – **Motorcultural Tests in Vineyards at Béziers.** — PAUL, P (Ingénieur Conseil Viticole), in *Le Progrès agricole et viticole*, Year 38, No, 7, pp. 168-171, figs 1. Montpellier, Feb. 13, 1921.

The Béziers trials are the first at which the practical solution of motorculture in southern vineyards has been considered and treated. They were carried out at the château de Lignan, in vineyards planted at a spacing of 1.75 m., partly in straight lines and partly in " gobelets, " on particlarly favourable ground formed of sandy alluvion. Fifteen machines took part in the tests.

In general, almost all the motor cultivators for vineyards which entered had 18-20 HP motors, giving a tractive force of 10-12 HP working an entire space between lines of vines, either with 5 furrows of a plough or with tillage implements ploughing or digging the same area. The tractive force required seemed therefore well determined. The work performed by the plough pattern machines seemed preferable provided that they can be substituted by implements with vibrating teeth for summer work.

The width of all the machines that entered was approximately 1 m., except one which was only 50 cm. and which was balanced by a wheeled spud working in the next space.

If the tillage implements were of the same width they would leave 37 cm. untilled on either side, with a spacing between the vines of about 1.75 metres, say hand work 70 cm. wide, which would be expensive and inadmissible; with a spacing between the vines of 1.50 m., 25 cm. would remain untouched on each side and hand work 50 cm. wide would have to be done.

Actually the borders remaining to be cultivated by hand in the case of the best driven machines were 45 cm. wide, corresponding to a spacing of the working implements of 1.25 to 1.30 m., while in the same vineyards, with horse traction, the borders which had to be tilled by hand were only 15 cm. wide, or one third of the width.

Under these conditions, which may be considered as extreme, driving is ticklish. The slightest deviation caused by the ground, the machine or the driving, entails damage to the vines in lines on wire palisades. In old vineyards that are not so well aligned and with vinestocks bearing old branches and spaced 1.50 m between rows, it would be almost impossible to use these implements because the deviation could only be straightened out by moving forward and this would tear the vines.

With a 20 H.P. engine taken as an ordinary basis, the work must be done in two operations, working 2 complete half rows in one, two or three parallel spaces between the vines at each transit. The working implements, suitably guided, could thus be brought nearer to or further from the vines as in ordinary work. The instrument of tillage, instead of having its 5 or 6 plowshares on the same frame, would have them on 2 separate frames.

The 18-20 H.P. tractor would be followed by 2 workmen each driving, for winter work, a triple plough instead of a single plough arranged with ploughs similar to those which experience has shown to be suited for each kind of ground. Implements suitable for summer work would be similarly worked.

In this way 1 tractor and 3 men could take the place of 7 teams, and get through more work as the machines would travel at an even, quick pace, less fatiguing for the men drawn by the tractor.

The driver, helped behind by the 2 men guiding and disengaging the implements, raised or not by the engine, would turn more easily and quickly without damage and could work the headlands. At a pace of 3.500 km. per hour (a maximum which should not be exceeded), 4 ha. could be tilled in one way per day. A tractor in similar conditions would till 40 to 45 ha.

The cost of paraffin or petrol for the tractor (about 35 litres) would be approximately the same as for the keep of 6 horses. Three men would be saved as well as the cost of feeding the horses for the many days on which they would be idle.

The cost of maintenance and repair of the tractor would be approximately equal to the cost of maintenance and replacement, in case of accidents, of the 6 horses.

The original purchase price of the tractor (20 000 fr.) would be less than that of the corresponding number of horses.

The recruitment of workmen reduced by $^2/_3$ would be easier and consequently more economical because they would only be required to guide the implements and not have to trouble with the driving and care of the horses.

With work distributed in this way it would be possible to carry out all winter work when the leaves are dead, digging up and cultivating the vineyards, and attached fields. The tractor used and served in this way should be economical. But that is not sufficient. Cultivation in vineyards becomes particularly active and profitable from the time that the branches begin to grow. The more cultivation is prolonged the better. It would be ideal to continue such work up to August.

The use of machines 1 m. wide entered at Béziers ceases be possible in April. From that date it would be necessary either to purchase horses or to use horses which had been fattening idly during the winter, which is economically impossible.

If therefore motor culture is to extend and become general is vineyards it will be necessary to have tractors of such a shape as will permit them to pass between the vines as long as horses can pass there, or even longer if possible.

To solve the problem all that is required is to fit the tractors so that they will pass over the vines (generally so that they will move in a plane about 1.25 m. above the level of the ground.

The tractor so constructed could straddle a line of vine-stocks and move on 2 suitably high wheels in two parallel spaces between the vines. Each wheel being 15 cm. broad and having separate control could pass at any season along the space between the vines. Steering would be done by a lateral hind wheel.

The tractor would draw suitable cultivators, sprayers and powdering machines, in short would carry out all cultural work, during 11 months of the year. The motor-cultivator would then become economical and profitable and find a large market.

A final effort of ingenuity by manufacturers should enable the same tractors, with a simple special addition, to act as transport, for the vintage.

To sum up, according to the author, although the competition of Béziers has not solved the economic problem of "motor-viticulture," it has decidedly put it in the way of being solved at a very early date.

849 – **Causes of the Greater Resistance met with by the Plough when Drawn Mechanically in Comparison with that met in the Case of Animal Traction.** — CASTELLI, M., in *L'Italia agricola*, Year 58, No 4, pp 97-100. Piacenza, April 15, 1921.

Capt. JULIEN (*La Motoculture*) admits that a plough, owing to the fact that it is drawn by a tractor which compresses the ground in front of it, meets with resistance 30 % greater than it would meet with if drawn by animals; he admits therefore that 30 % of the tractive power measured at the draw bar should be attributed to the tractor. The increased power rendered necessary by the use of the tractor may amount to as much as 50 %.

To clear up the question as to whether this increase should be attributed solely to the compression of the soil caused by the tractor, the author investigated the causes which might affect the unit effort (per sq. dm. of section ploughed) of the plough, assuming that the comparison is between ploughing done in the same soil, at the same depth. He limits his consideration to the influence of different conditions of ploughing respectively with a tractor and with animals which are: — 1) The weight of the plough; 2) the direction and position of the line of traction; 3) the compression of the soil; 4) the speed; 5) the errors which may be made in measuring the average force and the depth of ploughing have an importance which is not negligible.

Weight of the plough. — Ploughs for mechanical traction are always heavier than those drawn by animals by at least 10 kg. per sq. dm. of section ploughed; in soils with resistance of from 60 to 100 kg. per sq. dm., an increase in the resistance or tractive effort of about 10 % and often more, results.

Direction and position of the line of traction. — The author considers separately the effect of the slope up (angle between the line of traction and the horizontal) and that of the slope down (angle between the line of traction and the vertical plane of the side of the furrow).

In the case of animal traction the coupling point of the line of traction is always high (yoke for oxen or collar for horses), and it is always possible, by lengthening or shortening the draught, or even by raising or lowering the coupling point of the plough to obtain the slope which requires the least tractive effort, or else to obtain the minimum horizontal projection of that effort more easily. On the other hand, in the case of tractors, the line of traction is always very nearly horizontal; in certain cases, the author has noticed that it was even inclined downwards, so that the force was not at a minimum and that generally it is greater than in the case of animal traction.

The effect of the slope downwards of the line of traction is in practice still more important. It is very variable and greater for tractors, of great breadth which move entirely on the fallow with a short central coupling (in the centre of the axle of gripping wheels), for ploughing with a single plough body. The author considers that, when these conditions are simultaneous, they may cause an increased tractive effort which may exceed 30 %. On the other hand this effort may decrease to nil if the conditions are the reverse (tractors which move with one of the fixed wheels in the furrows; long draught; coupling to a bar jutting out sideways; use of multiple ploughs ploughing widths little less than the breadth of the tractor.

Soil packing. — Naturally in all but exceptional cases, the compression of the soil by the passing of the tractor increases its hardness; but up to what depth is the effect of the pressure noticeable by increasing the resistance to the edge of the ploughshare? The effect is more noticeable in the case of shallow ploughing; and perhaps only noticeable in such cases; but until the contrary is proved, the author thinks increases of 30 %, or even of 20 %, in the resistance may be excluded, since, according to him, the compression of the soil may very considerably increase the resistance to the ploughshare, much less that to the coulter, and scarcely at all that to the mould-board; so that to get total increased resistance of 30 % an increase of 50 %, in round figures, in the resistance to the ploughshare would have to be allowed, which is at least doubtful.

Speed of the plough. — It is generally thought that the resistance to the plough increases with the speed. But the author suspects that effort has often been confused with power. Often an increased speed improves the quality of the ploughing by helping disintegration and turning over, with a presumable increase of effort which should not be attributed to the tractor since it is compensated for by better ploughing.

Influence of the methods adopted on the measurement of the tractive effort and of the depth of ploughing. — The tractive effort is generally deduced from the displacement of a spring placed between the motor and the plough; the deviation of the line of traction from the line of movement is therefore not taken into consideration. The additional error made in neglecting the slope is compensated, wholly or in part, by the decreased work required with a moderate slope up; the additional error made in neglecting the slope down has to be added to the increased work due to the slope down itself. The measurement of the depth of ploughing is below the actual in the case of mechanical ploughing, because it is made from the surface of the fallow next to the furrow which has been compressed by the tractor; in the case of animal traction the measurement is above the actual, either owing to the raising up of the soil at the edge of the furrow or to the constant sideways movement of the plough.

Summary: — It is true that the resistance and, consequently the mechanical work, required for ploughing, is considerably greater when the plough is drawn by a tractor than in the case of animal traction, but the greater work (also noticed with windlass traction) should be attributed in a small degree to the compression of the soil and in a greater degree to various causes, such as the heavier weight of the plough, the downwards slope of the line of traction, the greater speed, and to systematic errors in the measurement of the depth of the furrow.

Regarding remedial measures, it is not necessary to trouble about the greater speed, since the greater resistance which results from that cause is compensated for by better ploughing; the greater weight is necessary, up to a certain point, to give greater stability which is indispensable owing to the greater speed; beyond that limit it should be avoided either by good material or by eliminating complicated mechanism for raising, steering, etc.; the effect of deviation of the line of traction, especially of the slope should down have the serious attention of manufacturers and agriculturists. Means eliminating errors of measurement of the depth of the furrow are known (use of pantographs, accurate horizontal planes for reference, etc.) but are laborious and they are not always applicable to tests laid down in competitions.

850 - **The Torelli Spraying Motor pump.** — BARDELLINI, S , in the *Giornale di Agricoltura della Domenica*, Year XXXI, No. 24, p. 190, figs. 2. Piacenza, June 12, 1921.

This machine is made by TORELLI Brothers, of Villa Sesso (Reggio Emilia) and is of two types: — 1) Mounted on its own truck; 2) mounted with the barrel of copper solution.

It is essentially composed of a 3 HP., 1 cylinder, benzol engine and a force pump. The motor runs at 800 revolutions a minute; it has controlled valves with high tension magneto, Zenith carburettor and centrifugal governor. Transmission is by cylindrical gearings; these work on a bent shaft, fixed on adjustable sockets; this shaft transmits the motion to the horizontal piston of the pumps. The latter is in bronze and is double action, that is to say with 4 valves which enable the force of the forward and backward strokes of the piston to be utilised. The pump, with 4 jets, gives a pressure of 7-8 atmospheres and the piston makes about 60 forward and 60 backward strokes a minute. It is provided with an ample compressed-air chamber with a special safety valve, adjustable to all pressures which allows the unused liquid to flow back into the barrel. The engine consumes about 9 litres of benzol in 10 hours', work and the four jets can spray about 10 quintals of copper solution an hour.

The pump works easily even for jets of a distance of 40-50 m.

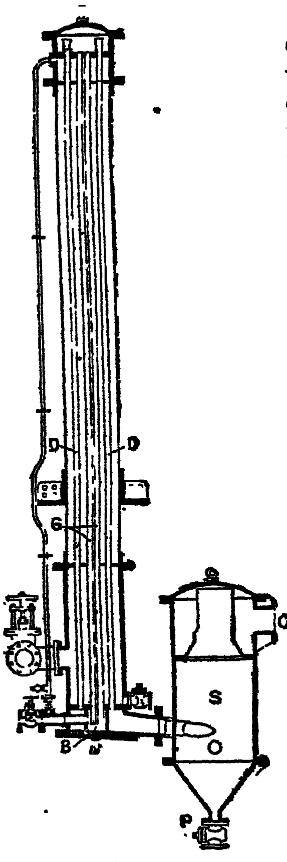
An arrangement enables any excess of copper solution, due either to rupture of the rubber or blocking of a jet, to pass back into the barrel.

To work the pump 4 persons are required for the 4 tubes, one for the motor and a child to move the rubber tubing.

The motor pump gives economy in the use of spraying solution and the spraying is more perfect because the jet, propelled at high pressure, penetrates the foliage better. As the machine moves along the paths there is no treading down of the crops.

851 – **The Kestner Concentrator.** — CAUVERGER E., in the *Revue agricole de l'Afrique du Nord*, Year 19, No. 97, pp. 456-458, figs. 2. Algiers, June 10, 1921.

The essential characteristic of this apparatus, already used in many establishments, is that they concentrate the juice in a single passage; the juice put into the apparatus passes out of it after a few seconds at the desired concentration.



Section of the KESTNER apparatus.

The process of working is as follows: —

The evaporator consists of a tubular bundle *G.D.* 7 m. long enclosed in a jacket which holds the steam for heating. The lower box is chambered and divides the bundle into two parts; one of which is attached to the tubing through which the unevaporated must enters, the other to a separator; this is the so-called " ascending and descending " method.

The unevaporated juice, drawn in by a feed pump, with regulated output is forced into the evaporator situated in the lower part of the ascending tubes first of all passing through a heater.

Under the influence of the heat it begins to boil rapidly, the closed bubbles of steam rise rapidly and carry with them the liquid in a thin layer along the heating walls of the ascending tubes.

When it reaches the upper part of the apparatus the liquid descends in a similar manner by a series of descending tubes in which concentration is completed.

Finally, the liquid being concentrated, the steam escapes at the bottom of the bundle and passes into the centrifugal separator where the separation of the concentrated liquid is effected and the concentrated liquid runs off by gravitation or is drawn off by an exhaust pump while the steam from the evaporation of the water taken out of the must escapes by the upper part into the air or is taken off by a vacuum pump, according as the apparatus works at atmospheric pressure or *in vacuo*.

The KESTNER concentrator can, in fact, work *inv acuo* if a vacuum pump and a water condenser are attached to it. In that case the evaporation temperature does not exceed 50°C. and this low temperature evidently adds to the certainty that the concentrated juice will not be changed in any way.

RESULTS. — Tests carried out by Prof. WARCOLLIER, Director of the Pomological Station at Caen, with apple juice gave the results indicated below in Table I.

But, and this is of capital importance for the concentration of grape musts, the apparatus can concentrate strongly sulphited musts by causing complete desulphitation See Table II, for the results obtained by Prof. WARCOLLIER with apple juice.

Finally complete desulphitation of strongly sulphited musts was obtained with a $^1/_{10}$ evaporation that, is to say with practically no concentration.

TABLE I.

Estimations calculated for 1 litre of juice	Must as it left the press	Same must after concentration at reduced pressure (vacuum = 35 ‰)	Same must concentration at atmospheric pressure
Density	1.045	1.3316	1.2906
Degrees Baume	6°	35.9°	32.4°
Saccharose. . . . . gm	8.4	61.5	52.5
Glucose . . . . gm	17.7	143	119
Levulose . . . . gm	66.9	503	432.05
Total dry extract at 100° C. . gm	115.2	857.2	738.4
Total acidity	2.2 per 1000	12.5 per 1000	10.7 per 1000

TABLE II.

Estimations calculated for 1 litre of juice	Must defecated and sulphited with 40 gm of sulphurous acid per hl.	Same must concentrated under reduced pressurs (vacunm = 35 ‰)	Same must concentrated at atmospheric pressure
Density	1.048	1.3428	1.2492
Degrees Baumé	6.6°	36.7°	32.7°
Saccharose. . . . . gm	8.4	64.2	54.5
Glucose . . . . gm	20.8	158.5	136.5
Levulose . . . . gm	67.9	521	439.5
Total dry extract at 100° C . gm	120.1	905.4	772.6
Total acidity	21 per 1000	12.9 per 1000	10.7 per 1000
Free sulphurous acid. . . . gm	0.025	nil	nil
Sulphur. acid in combination, gm	0.487	0.280	0.270
Total sulphurous acid. . . . gm	0.512	0.280	0.270

The quality of the products obtained leaves nothing to be desired; the rapidity with which the concentration takes place does not allow of any modification of the peculiar properties of the juice.

The working of the apparatus, once regulated, is automatic, requires no learning and can be attended to by any workman. It is quite easily cleaned; all that is required to keep it always clean is to pass a little water made slightly alkaline through it from time to time.

852 - **The Cirio Aeropycnometer for Measuring the Concentrations of Tomato Preserves** (1). — CARRASCO, A (Laboratorio chimico della Società generale delle Conserve alimentari "Cirio"), in *L'Industria alimentare italiana*, Year III, No. 1, pp. 6-8, figs. 2. Rome, Jan. 15 1921.

It is composed of 3 parts, in glass, easily put together: — 1) Central cylindrical container of the most suitable shape for filling with products of a soft consistency; 2) ground-glass stopper and 3) a graduated column connected with the floating bulb.

The graduation of the apparatus is based on a solution of sugar; the zero indicates the level at which the apparatus floats when the pycnometer is filled with distilled water; the 10th degree the level at which it floats when the pycnometer is filled with a 50 % solution of saccharose ($d = 1.223$); the interval is divided into 10 equal parts. As liquid for immersion distilled water is used or common drinking water can be used without affecting the result.

The central container must be filled without air bubbles; with this object a special pipette is used for products; of average concentration; for very concentrated products a kind of bag with a hood is used.

RURAL ECONOMICS

853 - **Researches into the Returns of Swiss Agriculture During the Years 1917-1918 and 1919-1920 Part 1** (Report presented by the Swiss Peasants' Secretariat to the Swiss Department of Public Economy). — LAUR, E. Director of the Secretariat, ZAUGG F. Chief of Division, and NATER, H. Assistant, in the *Landwirtschaftliches Jahrbuch der Schweiz*, Year 35, No. 1, pp. 91-173, Tables 38. Lucerne, 1921

This is the first part of a detailed account of the yields of Swiss agriculture during the agricultural years 1918, 1919 and 1920 (beginning on March 1), drawn up under the auspices of the *Swiss Peasants secretariat*, which has its head-quarters at Brougg (2).

According to an agreement made with the *Federal Department of Public Economy*, this 1st part (containing the results of general researches dealing with matters of which the publication is most urgent), will be followed by a 2nd part containing data referring to researches on the effect of the system of utilising the ground, and to the direction production is taking, as well as an account of a series of special investigations.

This first part of the Report is divided into 2 chapters: —

1) The Progress and Present condition of Swiss Agriculture;
2) The Results of Investigations into the Returns.

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(1) Made by Dr. BONAZZI and Co, Scientific instrument makers, Milan.

(2) This work is connected with others of the same character relating to preceding years, and of which the *Review* contains special résumes. See: *Investigations into the Returns of Swiss Agriculture During the year* 1913-1914 in *R.* Jan. 1916, Nos. 101 and 104; *Research work of the Swiss Peasants' Secretariat on the Swiss Agricultural yields During the years* 1914-1915, 1915-1916, 1916-1917 and 1917-1918, in *R.*, Sept. 1920, No. 907. — On the utilisation of the profits made by Swiss peasants, and the results of book-keeping by double entry, See *R.* Sept. 1917, No. 546, and *R.* May 1920, No. 571. (*Ed.*)

The progress and condition of Swiss Agriculture. — The authors furnish information and data regarding agriculture in Switzerland during the biennial period under consideration. and draw useful comparisons between this time and previous years as far back as 1901, the date at which the Secretariat commenced work. The information and data deal with the climate, unfavourable conditions for crops, yield, milk production, epizootic diseases, foreign trade, variations in price, rates of interest on mortgages, political economy, political events, the general business, situation, and summary of the agricultural situation.

The following is a summary of the observations of a general nature, or of technical and economic agricultural interest. In 1918, the February frosts produced large bare patches in the winter wheat-fields, the injury being aggravated by the atacks of wireworms (*Agriotes lineatus*). Many fields had to be resown with manitoba wheat or spring barley. The few fields that remained almost immune, were liberally manured with sulphate, of ammonia or cyanamide ot calcium and recovered fairly well. Injury due to straw blight (*Ophiobolus graminis*) was also observed in the fields of cereals, especially in those that had been re-sown. The dry spring of that year protected cereals well from the attacks of rusts (*Puccinia*) but decreased the leguminous and forage crops. Some late frosts did temporary damage; *Phytophthora* and leaf-curl did a little injury to the potatoes; the larvae and butterflies of *Pieris brassicae* were few in number, but nevertheless the Cantonal authorities ordered them to be caught. The vines and fruit trees promised well in March 1918, but they suffered from late frosts, and, subsequently, from the attacks of Geometrids, moths, aphids and *Anthonomus*; to these injuries must also be added the damage caused by the spring drought and the dry summer which made the fruit fall.

In the spring of 1919, a terrible hurricane due to the " föhn, " burst over Switzerland, and overthrew 30 or 40 % of the trees in the orchards and forests (1). This was followed by mild days, but subsequently there were late frosts which caused great injury to arboriculture and set back the spring crops. The oats were especially backward, and their germination was imperfect; in addition, much damage was done by frit fly, and the crops had to be resown in many places. Wheat and spelt suffered much from smut and the crops which were apparently healthy, sustained a loss amounting to from 10 to 30 %; these last years have appeared very favourable to this disease both in Switzerland and elsewhere (2).

(1) For the damage caused by this hurricane, see, GREYEYZ, Ueber die Föhnstarmkatastrophe vom. 4-5. Januar 1919, in Berner Oberland, dans *Schweizerische Zeitschrift für Forstwesen*, year 71, p. 2, Berne, Jan. 1921. (*Ed.*)

(2) According to MUNERATI's experiments, the late sowing of winter wheat and the early sowing of spring wheat promote the growth of smut, Cf. PEGLION, *Lemalattie crittogamiche delle piante coltivate.* Ottavi, Casale (Italy), 1912, p. 145 The same facts were noticed by JOVINO at Foggia, in 1918 and 1919; he considers that this recrudescence of smut during and after the War as due to defective cultural operations (of natural occurence at such an exceptional time), especially to the untimely preparation of seed-beds, and to sowing out of season Cf. *L'Agricoltura Materana*, Year 8, No. 2, Matera, Sept. 1920. (*Ed.*)

TABLES I. — *Cost of production in francs per hectare of cultivated area.*

Size of farms	very small			small			average			large			very large			average of all the balances		
Years	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19
Number of balances	38	48	392	167	159	1553	85	83	831	82	98	708	20	20	226	392	408	3710
Mortgages:																		
Capital buildings	50.03	60.74	40.62	33.56	34.55	25.95	28.40	31.41	21.25	22.60	24.42	17.55	15.62	17.10	12.83	30.83	33.70	24.01
» improvements	0.43	0.52	0.50	0.56	0.62	0.61	0.58	0.61	0.48	0.62	0.80	0.55	1.04	1.09	0.71	0.59	0.67	0.56
» tools and machinery	19.48	23.18	15.26	17.43	19.94	14.51	19.08	18.13	14.20	16.22	17.33	12.39	16.04	15.63	10.90	17.66	19.12	13.92
» vineyards	0.02	—	1.05	0.22	0.88	0.98	0.64	—	0.67	0.05	0.02	0.16	—	0.39	0.18	0.25	0.36	0.72
» fruit trees	1.60	1.03	1.09	0.73	0.55	1.17	0.42	0.52	0.90	0.21	—	1.07	0.06	0.16	0.35	0.60	0.45	1.12
» live-stock: cattle	20.03	46.30	21.71	17.72	30.07	17.43	25.82	39.09	17.80	18.92	32.10	15.22	23.92	28.18	16.46	20.27	34.21	17.45
» » horses	2.20	8.55	3.71	2.26	8.96	2.91	7.55	6.96	4.89	6.19	10.10	4.67	13.00	11.99	6.05	4.77	8.93	3.95
» » other kinds	3.47	5.75	1.62	0.49	2.15	0.85	0.82	1.26	0.52	0.77	0.43	0.41	0.42	1.15	0.29	0.90	1.93	0.73
Total of mortgage accounts	*97.26*	*146.07*	*86.16*	*72.97*	*97.72*	*64.41*	*83.31*	*97.98*	*60.71*	*65.58*	*85.20*	*52.02*	*70.10*	*75.69*	*47.77*	*75.87*	*99.37*	*62.46*
2. *Capital advanced for crops*	*2.01*	*2.78*	*1.15*	*0.81*	*2.08*	*1.37*	*0.78*	*1.48*	*0.71*	*0.40*	*1.60*	*1.00*	*1.24*	*1.79*	*0.85*	*0.86*	*1.91*	*1.09*
3. *Decrease of stocks-in-hand;*																		
hay and aftermath	20.73	25.61	12.91	16.07	14.04	10.74	16.14	13.51	9.74	13.06	10.01	6.68	5.51	8.37	6.86	15.37	14.05	9.49
straw and litter	1.21	9.03	3.83	0.96	8.14	3.10	2.33	7.36	2.78	0.56	9.32	2.83	0.24	5.22	2.32	1.16	8.23	3.22
potatoes	2.65	3.19	1.84	1.27	8.73	2.09	0.47	8.82	1.82	1.04	7.54	1.78	1.30	5.14	1.65	1.18	7.64	1.92
hoed forage crops	2.10	7.83	1.76	1.58	2.91	0.96	0.66	2.39	0.72	0.44	1.45	0.62	0.05	3.57	0.64	1.12	3.07	0.90
various field crops	0.88	0.43	0.55	0.53	0.51	0.28	0.29	0.72	0.27	0.24	0.80	0.24	0.29	2.47	0.40	0.53	0.71	0.29
cereals	2.65	6.19	2.12	4.67	8.09	3.16	4.38	9.71	3.30	8.49	8.13	3.58	5.30	11.11	3.80	5.24	8.35	3.22
stocks of different kinds	—	0.96	0.77	0.16	1.20	0.69	0.19	0.76	0.73	0.41	1.05	0.42	—	0.40	0.42	0.10	0.99	0.64
Total decrease of stock-in-hand	*30.22*	*53.24*	*23.78*	*25.24*	*43.62*	*21.02*	*24.46*	*43.27*	*19.36*	*24.24*	*38.30*	*16.15*	*12.69*	*36.28*	*16.09*	*24.70*	*43.04*	*19.68*
Current expenses of maintenance:																		
Incidental expenses	0.50	2.56	2.35	0.61	0.61	1.74	0.56	0.60	1.38	0.65	0.67	1.27	0.31	0.60	1.00	0.58	0.86	1.59
Purchase of manure	29.87	39.74	17.23	19.75	37.48	17.64	26.37	41.40	17.40	22.18	34.34	16.15	28.04	42.11	15.81	23.11	38.02	17.12
» » seed for forage crops	3.38	6.31	2.36	2.37	4.17	1.99	2.08	4.85	1.90	3.44	4.54	2.33	4.81	7.66	2.69	2.75	4.82	2.12

» seed for cereal crops	3.41	5.69	2.06	4.13	3.04	1.72	3.63	2.28	1.60	4.07	4.12	1.99	3.15	8.20	2.53	3.89	3.71	1.81
» seed for potato crops	3.07	5.49	1.77	2.02	1.52	1.08	1.88	1.75	0.98	1.46	2.61	1.00	0.55	3.00	1.04	1.90	2.37	1.12
» seed for other crops	1.61	4.06	1.07	1.43	1.88	0.71	1.23	1.37	0.54	1.73	1.75	0.64	1.61	0.95	0.54	1.48	1.96	0.69
Sundry expenses of forage crops	0.40	0.02	0.07	0.25	0.10	0.14	0.26	0.09	0.12	0.23	0.05	0.13	0.72	0.10	0.14	0.29	0.08	0.15
» cereal crops	1.08	0.08	0.21	1.15	0.34	0.36	1.19	0.67	0.36	1.09	0.61	0.39	2.09	0.64	0.48	1.19	0.45	0.38
» potato crops	0.22	0.03	0.10	0.29	0.24	0.21	0.66	0.17	0.21	0.45	0.43	0.37	1.04	0.43	0.38	0.44	0.26	0.24
» fruit crops	1.46	0.39	0.89	0.41	0.57	0.70	0.65	0.69	0.76	0.90	0.43	0.53	0.89	0.49	0.48	0.69	0.54	0.69
» vine crops	4.13	7.61	2.36	1.81	1.90	1.20	0.60	0.86	0.83	0.62	0.36	0.39	0.65	0.11	0.52	1.46	1.90	1.06
» forest crops	1.14	0.11	0.26	0.27	0.49	0.30	0.68	1.89	0.35	0.76	0.59	0.39	0.98	0.59	0.37	0.58	0.76	0.32
Purchase of compressed feeds	56.88	106.88	64.46	34.16	60.18	47.08	32.87	67.86	44.04	41.11	61.10	45.96	27.92	77.60	49.05	37.22	68.31	48.14
» forage seeds	6.56	12.48	7.56	4.24	12.58	6.83	10.01	19.13	10.26	5.44	15.29	10.96	11.21	18.00	15.22	6.32	14.82	9.90
» hay	17.48	38.19	25.85	14.83	36.32	16.33	11.72	17.07	12.09	14.71	13.87	12.05	10.79	11.99	9.50	14.19	26.04	15.14
» hoed forage croops	1.63	3.32	0.98	1.25	1.81	0.86	2.53	4.20	1.04	3.37	5.16	1.31	—	0.69	0.49	1.94	3.22	0.99
» litter	16.39	29.30	11.64	7.58	11.38	5.80	9.22	10.21	5.63	4.01	7.66	3.31	3.25	1.66	3.50	7.93	11.88	5.82
Veterinary service and medicine	4.90	4.16	3.09	3.52	4.25	3.08	4.61	4.10	3.03	4.29	5.12	3.29	4.33	6.59	3.48	4.09	4.53	3.13
Various expenses of the stable	19.58	21.77	19.15	12.74	16.29	13.30	13.53	15.63	11.70	11.57	14.81	10.29	10.24	13.45	7.80	13.28	16.30	12.67
Repairs to buildings	24.14	31.65	15.97	18.05	22.37	11.47	15.17	23.52	9.84	14.77	22.24	9.02	12.42	17.70	7.08	17.04	23.44	10.80
» tools and machinery	25.01	31.45	15.24	22.60	30.69	14.20	30.77	35.33	15.69	23.47	30.09	14.38	21.47	24.13	13.43	24.73	31.26	14.64
Taxes	23.30	25.56	16.44	18.76	22.40	15.06	15.47	19.85	13.21	14.65	17.18	11.94	6.19	15.13	7.02	16.98	20.64	13.70
Insurance	15.35	15.87	10.69	12.35	15.39	8.88	12.82	16.54	8.84	11.91	14.57	8.18	12.40	13.35	6.89	12.65	15.38	8.79
General expenses of administration	21.56	46.12	15.83	19.34	19.54	12.83	19.84	19.66	11.08	15.55	16.80	9.56	14.11	14.19	8.46	18.60	21.77	11.89
Lease of land	0.26	0.03	0.31	0.29	0.08	0.26	0.13	—	0.17	0.27	0.04	0.42	0.04	—	0.35	0.24	0.05	0.24
Costs of summer season	8.24	13.74	9.95	8.17	10.49	5.93	10.05	10.58	6.07	8.85	11.34	6.60	8.49	8.95	5.13	8.74	11.02	6.43
Motor power	6.65	4.53	2.15	6.70	6.37	2.54	5.31	6.40	2.52	6.73	7.30	2.98	13.43	7.81	3.51	6.75	6.45	2.60
Cortage	13.64	10.35	6.02	5.00	4.94	3.45	5.0	4.17	2.61	2.19	2.59	1.15	2.27	2.25	0.71	5.11	4.72	2.90
Sundries	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total workin cost	*311.84*	*467.49*	*256.06*	*224.07*	*327.42*	*195.69*	*239.34*	*330.87*	*184.25*	*220.87*	*295.66*	*176.98*	*203.40*	*298.43*	*167.60*	*234.17*	*335.56*	*194.17*
Current account at Bank	*4.38*	*0.85*	*3.50*	*0.27*	*1.08*	*0.67*	*1.06*	*0.64*	*1.20*	*0.19*	*1.23*	*0.76*	*2.19*	*2.15*	*0.81*	*0.92*	*1.05*	*1.09*
Interest on working capital	*352.00*	*426.55*	*323.86*	*276.15*	*295.23*	*251.34*	*253.59*	*277.53*	*234.08*	*219.21*	*245.53*	*206.83*	*177.29*	*193.91*	*157.39*	*261.66*	*290.17*	*240.62*
Cost of labour	*849.01*	*1023.15*	*574.89*	*619.35*	*760.82*	*431.94*	*498.37*	*621.29*	*349.74*	*427.52*	*525.23*	*301.78*	*352.39*	*444.14*	*245.85*	*561.63*	*691.19*	*392.59*
TOTAL COST OF PRODUCTION	**1646.72**	**2120.13**	**1269.40**	**1218.86**	**1527.97**	**966.44**	**1100.91**	**1373.06**	**850.05**	**958.01**	**1192.75**	**735.52**	**819.30**	**1052.39**	**636.36**	**1159.81**	**1462.29**	**911.70**

The summer pastures were poor, and were injured, by cockchafer larvae, the hoed crops were fairly good, but the potatoes, though sound when lifted, were attacked later, in store, by dry rot. Field-mice also contributed their quota to the damage. Fruit was scarce, but vegetables, with the exception of kidney-beans, were good.

The report contains data referring to the crops of 1917, 1918, and 1919 expressed in percentages of the average for the preceding decade. It also contains tables giving the milk production during the same period — all information which has been obtained by the *Central Office of the Swiss Peasants' League for Communicating Prices*; the monthly consignments of milk to the cheese factories and milk-collecting centres are also given.

The number of Associations for supplying milk vary annually from 1384 to 1598; a total of 477 238 kg. in 1917, 471 222 kg. in 1918, and 402 868 kg. in 1919. On account of the enormous drop in production in 1919 (to 62.3 % of that in 1914), milk ration cards were introduced.

The statistics referring to epizootic diseases from 1886 to 1919 are of special interest, and show great variations in the prevalence of foot-and-mouth disease. This disease was worst in 1913, when there were 45 966 cases among the cattle and 22 125 among smaller stock. During the last 5 months of 1919, it was exceptionally severe both in Switzerland and Italy, 50 % of the cases being in some instances fatal, which meant sheer ruin to the Swiss.

The imports and exports are given from 1885 to 1919. As regards the variations in price, the *Central Office* was able to verify these every month by means of its agents all over Switzerland, who sent information on the subject once or twice every month.

Of the many data referring to different agricultural products for the years 1870 to 1919, the basis adopted (100) was the average price from 1900 to 1909, it is enough to mention that the highest prices were in 1918; in round figures, 431 for tobacco, 449 for wine, 445 for vegetables, 497 for pork products, and 431 for eggs, with a general average of 310.07. In 1919, there was a considerable fall in prices, the average being 291.50 except in the case of milk which rose, and from 17.05 centimes per litre in 1914 gradually reached 25 65 centimes in 1917, 30.75 in 1918, and 34.40 in 1919.

The interest on mortgages rose on an average in the 28 Institutes of Credit from 4.143 % in 1900-1905, to 4.908 % in 1917, 4.915 in 1918, and 5.055 % in 1919.

In 1918, the Office of Food and other similar war institutions found themselves confronted by serious difficulties, and agriculturists had to submit for a second time to the compulsory planting of crops. Cattle were exported by way of compensation, but trade was increasingly difficult, owing to the depreciation of the foreign exchanges. Switzerland could not escape the effect of the economic depression that followed the defeat of the Central Powers.

An improvement took place in the second half of 1919, the year, when, owing to the removal of trade restrictions, Switzerland was able to throw large reserves of goods upon the markets where production was held up by strikes and sabotage, but the high foreign exchange was a serious obstacle. As a matter of fact, Switzerland itself was not free from strikes, but the local agriculturists restored the order disturbed by the strikes of Zurich and Bâle.

The elections of Oct. 1919 (which were proportional for the first time in Switzerland) gave unexpecteed power to social democrats and to the agrarian party.

During the last two years, artisans have, as a rule not suffered from want of employment in the country, although this was not often the case in the towns.

Results of researches on returns. — Book-keeping by simple entry is employed by the Secretariat (1). From 1918 to 1920, the number of farms whose books were submitted for examination increased in a very satisfactory manner. In 1919, the Secretariat received, at the right date, 405 book-keeping returns for the financial year 1918-1919, and 392 of these could be used as a basis for statistics; in 1920, the Secretariat received 426 returns for the year 1919-1920, and 421 supplied balance sheets that could be utilised.

1) *Production costs.* — Table I, which has been reproduced as it stands from the publication in question, gives the production cost per hectare of cultivated area for each of the 5 classes of farms, arranged in decreasing order of size, viz., *a*) *small farms* (3 to 5 hectares ;) *b*) *small peasant farms* (5 to 10 hectares); *c*) *peasant farms* (10 - 15 hectares); *d*) *large peasant farms* (15-30 hectares); *e*) *very large* farms (over 30 hectares). The monetary unit is the franc at par, and simple interest is calculated.

Table I is followed by notes on each sub-group of accounts, giving the method of enquiry, any possible unusual influences, and deductions of an economic and social character.

Under the head of *depreciation*, the annual wear and tear of objects in daily use is taken into account. In order to estimate, in a somewhat conventional manner, the difference between the purchase price (initial value) of an object, and its value when it can no longer be used (final value) is divided by the number of years it has been used; in this way, the annual depreciation is obtained. In the case of plantations, lots are taken. As regards cattle, the register of the number of head is customary in Switzerland. The depreciation of cattle is calculated on the basis of information obtained by means of a special book-keeping formula giving the depreciation, or plus-value of each animal. The high depreciation figures of late years are due to the fact that, the accountants were obliged to conform to the high war prices. The authors, however, are of opinion that these figures were actually too low, because the high war prices, at which cattle forming the stock capital were purchased, must soon, perhaps in 4 years, fall to their normal level.

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(1) Cf. E. Laur., *Grundlagen und Methoden der Bewertung, Buchzltung und Kalkulation in der Landwirtschaft*, Parey, Berlin, 1911, p. 129; also " *Les Offices de comptabilite agricole dans les divers pays*, Inst. Intit. of Agric., Rome, 1920, p. 184. (*Ed.*)

The accountants raised the rate of depreciation of the cattle each time that the prices showed great variation, no matter whether they fell (1914) or rose (1919).

For 100 francs of the capital under consideration, the accounts show the variations in annual depreciation given in Table II as the average for the different classes of farms for the period 1909-1919.

TABLE II. — *Variations in annual depreciation* (in %).

	Buildings	Improvements	Implements and machines	Horses
Minimum . .	1.08 (1908-1910)	2.14 (1916)	5.06 (1908-1910)	3.66 (1908-1910)
Average (1908-19). .	1.44	2.57	5.29	6.34
Maximum . .	1.76 (1916)	2.87 (1919)	5.95 (1915)	10.54 (1919)

The average depreciation of the horse capital was 7.9 % in 1918, and 10.5 % in 1919; 10 % being the estimate according to rule.

On the other hand, the average annual depreciation of the cattle between 1913 and 1919, was 3.96 % with variations ranging from 1.95 % (1916) to 6.85 (1914) for time and between 3.68 (small farms) and 4.67 (very large farms) for area. The average for cows considered separately was 5.9 % with variations from 2.81 (1916) to 9.5 (1914) and from 5.3 (small farms) to 6.2 (very large farms).

If the repairs and depreciation of machinery and implements are added the purchase cost of small objects of inventory, together with interest at 5 % and 0.2 % allowed for taxes and insurance, we obtain the sum of the annual allocation, which for the years 1908-1919, can be estimated on an average at 16.66 % of the capital employed, and for 1918-1919 at 19 %.

As regards the crop account, the authors leave out of consideration the actual outlay, as it a question of book-keeping by single entry, and merely consider the extraordinary cultural operations of which the effects will only be shown in future years and they register a decrease in the cost of production, and an increase in the annual gross production. The small amount of the crop account estimated in this way is perhaps due less to the low rate of depreciation than to the amount of capital placed in crops, as this has greatly decreased during the war.

By stock in hand is to be understood all the raw material produced on the farm and of which the greater part is consumed on it. The increase in value at the end of the year is credited to the total gross produce account, and the decrease to the cost of production. The small difference due to the stock in hand is explained by the fact that the agricultural year begins with March 1. Of recent years the stock in hand also increased with the prices.

The *working expenses* («Betriebskoste») include, in the first place, the *cost of running the farm* («Betriebsausgaben») exclusive of payment of interest, wages, the purchase of live stock, and all the out goings that increase the estate capital or the dead stock; into this account also come any expenses incurred under the three heads of houschold, dependant branches, and family, and finally all changes in the inventory due to purchased raw materials. The working expenses have risen considerably of recent years owing to the increased cost of goods, and to the more intense system of, agriculture adopted.

Table III. gives the quinquennial averages of the working expenses per hectare cultivated as calculated from the authors' Table.

TABLE III — *Quinquennial averages of working expenses* (in francs).

Years	Area of the farms					Average
	3–5 hectares	5–10 hectares]	10–15 hectares	15–30 hectares	Above 39 hectares	
1908–1913 . . .	219	171	156	154	143	**169**
1914–1919 . . .	293	220	212	200	192	**220**

In 1919, the working expenses per hectare attained their maximum, being 100 % above the average for 1908-1913, and 1 % above that for 1914-1915. It must be noted that the increase of these expenses was in inverse proportion to the size of the farm, a fact which is not without effect upon the returns.

The charge of the current banking account on the production expense was very small, for as a rule in Swiss agriculture, this account is rarely used for obtaining credit; it is more often employed for making payments.

The rate of interest on the various capital accounts are calculated as follows: —

Estate capital	Land.	3.5
	Improvements	4.0
	Buildings	4.0
	Plantations	4.5
Farm capital		by difference (1)
Working capital (total)		4.0

The interest on the capital is on the increase, especially in 1919. That on the farm capital is steadily and considerably increasing; in this respect the figures for 1919 show a rise of 56 % as compared with the average for 1913-15. The interest on the land capital in 1919 is 10 % higher than the average for 1913-17, owing to the purchase of land at high prices. This fact has however, but little effect upon the total production expenses; in fact the increase observed in 1919 only amounted to 0.9 % of the production expenses for the period 1913-17. The interest of the money invested in buildings has altered in a similar manner.

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(1) It is a question here of the difference between the total interest on the working capital and that on the estate capital.

Cost of labour (*"Arbeitsaufwand"*) includes: — *a*) All the expenses connected with all workers other than members of the family; these expenses usually consist of wages, board and payment in kind; *b*) the customary remuneration paid to members of the family in cash for manual work and management, these being calculated at the rate fixed for salaried hands (1).

The authors give in detail the increase in, and the apportioning of, these payments for the years 1901-1919. It suffices to give a summary here of the maximum, minimum and average for farms of different sizes. It is to be understood, that by working day is meant the entire work that can be performed by an adult man of full strength in one day.

TABLE IV. — *Increase and apportioning of the cost of labour from* 1901-1019.

		Minimum	Average (1901-1919)	Maximum
		fr.	fr.	fr.
Cost per hectare of work	farmer's family	185.50 (1901)	231.49	445.20 (1919)
	salaried hands	71.85 (1901)	118.70	245.99 (1919)
Days of work per hectare	farmer's family	47 (1910)	53	60 (1904)
	salaried hands	26 (1902)	33	35 (an. div.)
Cost of work per day. .	farmer's family	2.70 (1905)	3.76	8.04 (1919)
	salaried hands	2.17 (1901)	3.15	5.83 (1919)

In the average for 1901-1919, the ratio of the days of work performed by the family and salaried hands per hectare is 123 :19 for very small farms, 84:28 for small farms, 58:29 for average sized, 36:39 for large farms, and 20:35 for very large farms.

The sum of the preceding figures gives the *total cost of production for the farm*, and this, minus the interest on the working capital, gives the *working-expenses* (" betriebsaufwand "). The Secretariat gives the cost of production since 1908, and the working expenses since 1901. to find the cost of production for each article of produce, special calculations are required.

In the general average of the farms, the increase in the cost of production, as compared with the preceding average for 1908-1917, may be apportioned in round numbers as follows: — To cost of labour 66 % in 1918, 54 % in 1919; to current working expenses 18 % in 1918, 26 % in 1919; to interest on capital 9 %. Of the latter 6 % is on the farm capital, and 3 % on the estate capital, of which only 1.3 % is represented by the land capital.

2) *Gross Return*. These are exactly reproduced in Table V (pp. 1026) extracted for the Report.

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(2) See LAUR, l. c, p. 113 (*E. d.*).

It should be noted that the gross-returns account is divided under 3 sub-headings i. e., sales account, gross-returns account proper, and complementary accounts.

From 1915 to 1919, the prices fetched, per quintal by fodders and cereals in Switzerland and registered by the Central Bureau, are given in Table VI.

TABLE VI. — *Prices of fodders and cereals in Switzerland from* 1915 *to* 1919 (*francs per quintal*).

	1915	1916	1917	1918	1919
Wheat	38.34	44.65	60.15	64	64
Spelt	27.39	35.48	51.25	52	50
Oats	33.98	41.16	54.53	62	61.50
Rye	32.96	41.77	58.80	64	63.37
Potatoes	13.44	18.71	20.11	20.80	20.99
Hay	9.03	12.05	13.77	17.00	30.06

The variations in the sales account given in the text show that until the end of 1917, the sales and consignments of potatoes and cereals per hectare were the same; that until the war, all the sales decreased (8 % of the total gross returns from 1908 to 1917) in proportion to the reduction in the fields cultivated, then rise considerably until 1918 (15.7 %), and again fell in 1919 (13.8 %), at the time when compulsory cultivation and requisitions were no longer in force.

The authors give the crops from various trees with the unit prices, or indices; the data show that the gross yield of the trees greatly increased during the last three-year period.

The gross returns from the cattle are derived from: — Increase in number, milk and its products, service of bulls, carting, etc. Usually, milk production rises, and the increase in the number of the stock declines when the farm becomes larger. The large increase in the stock that began in 1915 and attained its maximum in 1918, can be explained by the reduced milk production, and the high price of cattle. During the last 5 years, the number of young cattle in the spring per farm was as follows: — 2 3 (1920) to 3.4 (1916) on an average inv *ery small farms*; 3.6 (1915) to 4.5 (1917) for *small farms*; 5.4 (1915 and 1919) to 6 (1918) in *average sized farms*; 7. 5. (1915 and 1919) to 9.7 on *large farms*; and 12 (1915) to 16.7 (1917) on *very large farms.* The prices per quintal of live weight show that the prices in 1919, were in round numbers three times what they were in 1913.

The data of the gross dairy returns are most interesting. The price curve shows a first maximum (20 centimes per kg. of milk) in 1912, followed by a minimum in 1914 (17.05), then another rise continuing until 1919 (34.40), the year when the reduced production was compensated for by the high price.

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TABLE V. — *Total Gross Returns in Francs per hectare of cultivated area*

Size	very small			small			average			large			very large			Average of all the balances		
Year	8	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19	1918	1919	1908/19
Number of		48	392	167	159	1553	85	83	831	82	98	708	20	20	226	392	408	3710
1. *Increase in stoc in hand :*																		
Hay and aftermath	3.76	5 74	16.39	6.91	11.05	13.04	3.38	9 47	11.33	2.43	8.93	9.29	7.69	4.47	9 15	5.91	9.27	12.08
Straw and litter	3.35	11.07	6.07	10 24	3.79	4.13	8.61	3.52	2.92	11.56	2.87	3.26	9.29	1.97	2.56	10.42	4 28	3.79
Potatoes	6.37	9.21	5.12	11.37	5.76	4.03	11 36	2.34	2.93	12.20	4.30	3.98	13.05	6.18	3 26	11 14	5 14	3.84
Hoed forage crops	2.26	0 92	1.82	2.22	1.55	1.10	1.24	1.15	0 68	2 34	0.58	0 94	4.29	0.40	0 87	2.15	1.11	1.04
Various field crops	2.62	0.65	0.72	0.50	0.17	0.39	0.09	0 44	0.32	0.38	0.25	0.33	2.86	1.40	0.56	0.84	0.36	0.40
Cereals	2.93	15.68	8.42	21.17	9.81	7.23	17.77	13.22	7.28	20.94	10.60	9.04	28.03	9.51	7 29	20.65	11.37	7.72
Farm manure	—	—	0.01	—	—	0.03	—	—	0.01	—	—	0.04	—	—	0.10	—	—	0.02
Stocks of different kinds .	1	3.43	2.39	1.72	1.41	2.27	2.46	0.94	1.74	1.66	2.60	1.11	2.78	4.47	1.08	1.85	1 99	1.92
Total increase of stock in han	2	*46.70*	*40.94*	*54.13*	*33 54*	*32.22*	*45.51*	*31.08*	*27.21*	*51.51*	*30.13*	*27.99*	*62 99*	*28.40*	*24.77*	*52.96*	*33 52*	*30.81*
2. *Capital advanced for crops*	*0.*	*1.69*	*0.89*	*2.10*	*3.57*	*1.61*	*4.59*	*3 65*	*1.46*	*2.69*	*1.66*	*1.19*	*0.09*	*3.86*	*1.01*	*2 53*	*2.85*	*1.3*
3. *Net returns :*																		
Sale and consignment of cer	9.	84.23	36.22	126.13	107.12	40.90	106.49	103.64	35.19	144.84	117.25	42.72	162.08	132.76	42.73	125 —	107.40	39.6
» straw	8	4.72	3.06	7.97	7.42	3.68	7.92	7.50	3.22	6.77	9.78	2 83	13.13	12.18	3.21	8 —	7.92	3.3
» potatoes	4.	69.84	42.22	105.70	60.76	34.55	85.13	62.82	30.00	98.44	60.15	32.15	122.01	61.49	33.92	100.42	62.15	33.38
» various hoed	[illegible]	1.33	2.92	11.33	5.56	2.65	4.68	2.41	1.16	4.79	2.77	1.91	14.88	7.85	2.42	8.78	3.86	2.17
» various field	6.	29.20	12.65	20.76	13.81	8.53	15.76	10.31	5.11	25.09	13.17	5.99	20.01	10.15	4.76	22.04	14.58	7.51
» hay	6	90.57	19.96	16.48	30.89	14.19	19.38	17.45	13.43	14.50	22.48	7.86	14.49	12.51	7.29	16.58	32.27	12.66
» litter	4.	0 62	1.48	3.82	5 46	2 —	17.38	12.62	3.63	1.26	3.38	0.66	0.48	1.00	0.31	6.13	5.63	1.9

Total of expenditure and sales	280.86	280.61	219.51	290.19	231.02	106.50	256.74	216.75	191.74	295.69	228.98	94.12	347.08	237.94	94.64	286.95	233.81	102.10
Gross arboricultural returns:																		
Fruit, cider, etc.	203.99	193.19	99.02	195.82	190.13	110.78	197.20	185 76	96.01	88.34	113.44	54.47	59.52	101 43	44.39	167.47	166.83	91.35
Wood, growth of trees etc.	22.58	14 —	10 77	10.20	12.61	8.29	7 66	8.29	6.89	4.64	5.64	4.50	3.69	4.28	2 64	9.35	9.81	7.17
Gross return of vines	112 55	137.77	44 60	68.63	32.66	27.11	54.92	26.76	24.24	18.68	4.91	5.47	18.49	12.32	13.60	56.91	36.16	23.42
Gross forestry returns	52.53	37.22	24.21	70.07	64.05	31.53	64.93	62.21	32.38	75.22	67.89	38 13	68.78	70.67	30.45	68.27	61.75	32.10
Gross cattle returns:																		
Increase of stock (not counting calves to be fattened)	445.49	353.34	245 51	468 84	395.35	212 16	422.35	326.61	184.32	353.66	286.48	166.62	317 67	237.34	141.20	424.69	342.52	195.93
Milk and milk products	541.59	493.39	347.39	436.97	450.40	339.67	440.99	467.87	333.75	393.05	403.92	318.05	307.96	328 95	281.33	432.38	441.90	331.29
Calves for the butcher	14.30	34.69	30.20	10.89	21.58	18.10	10 96	27.77	12.09	8.15	15.12	11.05	9.22	18.69	8.66	10.58	22.69	16.25
Carting and sundries	7 93	13.50	6.95	9 94	14 97	8.61	12.75	10.40	9.54	11.63	9.37	8.21	11.10	12.62	7.78	10.77	12.41	8.50
Gross horse returns:																		
Breeding	1.40	—	1 71	8.75	6.83	3.88	9.66	15.96	4.99	16.91	13.14	7.78	22.29	15.54	8 64	10.63	9.83	4.97
Cartage and sundries	76.07	19 56	17.94	16.04	30.01	13.69	53.21	44 92	22 26	22.51	24.80	16.35	7.14	21.84	9.17	30 82	30.16	16.10
Gross returns of farm:																		
pigs	208.87	286 —	121.72	157.14	195.01	88.67	135.29	174.27	75.33	160.07	165 78	81.96	144.79	172.07	74.54	157.50	193.35	87.01
goats	11.23	7.74	4.34	2.54	2.67	1.25	1.83	0.90	0.84	0.62	0.33	0.55	0.34	0.32	0.58	2 72	2.23	1.30
sheep	9 32	9.03	7.71	7 36	6.81	2 85	10.28	6.32	3 39	4.47	3.81	2.05	5.01	3.38	1.93	7.36	6.08	3.23
bees	67 42	13.59	23 51	24.39	10.80	9.14	18.48	8.71	5.45	30.22	7.06	6.26	12.41	3.86	2.12	27.89	9 47	8.87
Total Gross returns proper	*1775.27*	*1613.02*	*985.58*	*1487.58*	*1433.38*	*875.73*	*1440.51*	*1266.75*	*811.48*	*1188.97*	*1121.69*	*721.50*	*988.41*	*1003.31*	*627.23*	*1417.34*	*1345.19*	*827.49*
Rent of building	89.79	117.39	83.92	51.77	49.39	47.60	40.36	41.02	37.17	28.86	29 13	30.52	17.13	20.71	15.78	46.42	49.40	43.82
Lease of land	3.69	7 11	3.10	3.69	3.37	2.59	3.35	4.27	2.37	3.33	3.33	1.76	1.89	1.16	0.71	3.45	3.88	2.31
Improvements and increase of the estate capital and dead stock	5.16	10.09	5.11	3.96	6.86	4.22	1.64	3 58	2.31	1.19	1.84	1 65	1.59	2.01	1.05	2.88	5.14	3.33
Interest on reserve capital	2.93	0 46	1.06	0 42	0.37	0.70	0.93	1.23	0 84	0.96	1.11	0.72	0 06	0.60	0.40	0.87	0.75	0.74
Various returns	10.41	32.08	11.16	17.30	21.88	8.67	9.30	13.25	5.11	10.19	10.82	4.05	4.70	6.07	3.30	12.74	17.89	7 01
Total complementary account	*111.98*	*167.13*	*104.85*	*77.14*	*81.87*	*63.88*	*55.58*	*63.35*	*47 80*	*44.53*	*46.23*	*38.70*	*25.37*	*30.55*	*21.24*	*66.36*	*77.06*	*57 11*
Total gross returns	*2168.11*	*2060.76*	*1203.94*	*1856.91*	*1746.77*	*1046.11*	*1752.83*	*1646.85*	*951.02*	*1529.19*	*1396 90*	*854.32*	*1360.86*	*1271.80*	*743.11*	*1770.65*	*1656 06*	*985.70*
4. *Current Banking account*	*0.74*	*4.13*	*1.16*	*2.05*	*2.83*	*1.12*	*2.16*	*1 78*	*0.92*	*2.12*	*3.43*	*1 09*	*1.20*	*3.20*	*0.55*	*1.92*	*3.01*	*1.50*
TOTAL GROSS RETURNS	**2231.96**	**2113.28**	**1246.93**	**1915.19**	**1786.71**	**1081.06**	**1805.99**	**1683.36**	**980.61**	**1585.51**	**1432.12**	**884.59**	**1425.14**	**1307.26**	**769.44**	**1828.06**	**1695.44**	**1018.93**

Pig-breeding is practised most on small holdings, and has proved very remunerative of late years, owing to the high unit prices. The same holds good as regards other stock.

3) *Net returns.* — These are the returns on all the working capital belonging to the farmer, or borrowed by him, and can be calculated in different ways.

a) Total gross returns — Working expenses = Net returns.

b) Agricultural returns + interest on reserve capital — Remuneration of farmer and his family = Net Returns.,

The authors show the variation of the net returns from 1901 to 1919, on the one hand, as a percentage of the working capital and, on the other, per hectare of area under cultivation, including forests. These data are summarised in Table VII.

Further, between 1901 and 1919, in the average of all the farms the total gross returns were divided into 67.7 % for working expenses, and 32.3 % for the net returns (30.9 in 1919), respectively, the working expenses ranging from 49.1 (1918) to 84.1 (1913) and the net returns from 15.9 (1913) and 50.9 (1918). Under the same conditions, 100 fr. of working expenses correspond to 44.63 fr. of net returns varying at the time between 18.84 (1913) and 103.54 (1918) (44.65 for 1919) and, in proportion to the increasing size of the farm, in round numbers as 28 : 44 : 49 : 54 : 57.

All the net return accounts show that the relative net return, that is to say the return per hectare, is less high in small farms. Hence, the large farm has the advantage over the small one from the point of view of the returns it furnishes to the farmer himself, but the small property proves itself equal, or superior, to the large from the standpoint of national economy and the possibility it offers to the farmer to engage in accessory occupations.

4) *The return on the net capital* obtained by the method of ponderable averages constitutes the remuneration of the net capital engaged in the farm (not including the goods belonging to the honsehold and dependent branches). It can be calculated in two ways:

a) Agricultural income — Remuneration of the labour of the farmer and his family = Returns on the net capital.

b) Net returns — Interest on reserve capital = Returns on net capital: —

Further: —

Returns on net capital — Interest on net capital = Gain or loss of the farmer.

Of recent years, the returns on the net capital have generally been higher than the net returns. This is because the interest on the borrowed capital has always been less than the increased nèt return that it is has been possible to obtain ; the interest on the net capital has increased by this difference.

(5) *The remuneration of the labour of the farmer and his family* is calculated as follows:

TABLE VII. — *Variations in net returns from* 1901-1919.

Year	Farms										General average	
	very small		small		average		large		very large			
	%	per hectare	%	per hectare	%	per hectare	%	per hectare	%	per hectare	%	per hectare
1901–1905	2.33	143.14	2.39	133.13	3.02	140.88	3.16	143.65	4.25	142.10	3.07	141.15
1905–1913	2.09	134.33	3.48	209.50	3.64	195.13	3.83	193.29	4.35	154.28	3.65	188.36
1914–1919	5.78	485.58	8.03	532.30	8.56	530.00	8.74	480.09	10.62	429.10	8.58	510.28
1917	8.04	630.02	10.13	665.55	9.94	588.19	10.92	594.15	11.72	490.97	10.44	621.09
1918	10.82	937.24	14.29	972.48	15.17	957.77	15.23	846.71	17.76	784.13	15.05	929.91
1919	4.18	419.69	7.57	553.97	8.53	587.84	7.91	484.92	9.39	448.79	7.94	523.32
1901–1919	3.32	247.50	4.63	291.50	5.03	286.50	5.24	270.80	6.34	237.90	5.05	277.60

TABLE VII. — *Variations in net Capital in % of the Capital.*

Year	Farms					general average
	very small	small	average	large	very large	
1901–1905 . . .	1.34 %	1.60 %	2.52 %	2.46 %	5.11 %	**2.46 %**
1906–1913. . . .	0.77	3.14	3 50	4.13	5.65	**3.61**
1914–1919. . . .	7.40	10.73	11.97	11.61	18.30	**11.85**
1917	11.61	12.20	14.06	15.25	18.91	**14.25**
1918	17.09	22.72	24.27	22.71	32.83	**23.96**
1919	4.27	9.73	11.62	10.10	14.99	**10.50**
1901–1919. . . .	2.93	5 16	5.92	6.05	9.52	**5.92**

Agricultural Income — Interest on the net capital = Remuneration of the labour of the farmer and his family.

This remuneration, which is calculated in kind per working day of an adult man, was low before the war* (on an average from 1.19 fr. to 4. 55 fr. for the 5 classes of farms between 1901 and 1914), but afterwards it rose rapidly.

If 5 % is the rate of interest on the capital, the amount remaining for the remuneration of the farmer and his family is that given in Table IX

(6) *Agricultural income.* — By this is understood all that can be used without decreasing the net capital. It is estimated in two ways, of which the simpler is as follows: —

TABLE IX. — *Remuneration of the Work of the Farmer and his Family*

(in francs per day)

Size of Farms		1916	1917	1918	1919
3–5 hectares	3.74	4.90	7.66	11.06	7.44
5–10 » . .	4.91	6.88	10.84	15.20	11.32
10–15 »	5.67	7 77	12 01	20.57	14.77
15–30 » . . .	6.96	12.31	18.22	29.48	16.95
Over 30 »	10.90	16.17	22.59	41.36	21.79
Average (at 5%) . . .	**5.77**	**8.40**	**12.87**	**20.20**	**13.37**
Average (at 4%) . . .	**6.39**	**9.04**	**13.53**	**20.63**	**14.13**
Difference	*0.62*	*0.64*	*0.66*	*0.43*	*0.76*

Consumption of the farmers family + Variations in income = Total income.

Hence we deduce: —

Total income — (Household income + income from independent branches) = Agricultural income.

TABLE X. — *Agricultural Income + Household Income from* 1901 *to* 1919

(in francs)

Years	very small	small	average	large	very large	General average
			Per Farm:			
1901–1905	2040 45	2728 40	3568 15	4552.80	6018.00	3452.05
1906–1913	2024.20	3281.40	4307 50	5590.75	6581.00	3990.25
1914–1919	3952.25	6575 17	9338.75	12107.69	18511.78	8750.73
1917	4841 80	7467.50	10066.40	14345.90	21630.95	9928.40
1918	6214.18	10522.07	14981.60	20298.18	32363.57	14230.83
1919	4632.23	8409.23	11620.14	14169 89	24149.80	10773.37
1901–1919	2670.50	4256.49	5820.29	7565 73	10432 82	5457.48
			Per Hectare:			
1901–1905	506.80	365 20	272.45	213.85	144.20	263.50
1906–1913	517.55	432.45	337.00	270 20	158.20	312.90
1914–1919	993 12	870 56	752 52	594.43	448.53	679.62
1917	1169 05	988.85	820.90	704.40	525.40	783.90
1918	1155 08	1407.78	1206.14	964 44	798.64	1117.51
1919	1186 55	1115 91	934.23	677.81	536 58	819.02
1901–1919	673.69	563.54	461.17	365.75	250 74	424.17
			Per Working-day of members of the Family:			
1901–1905 . . .	2.82	3 25	3.65	4.14	5.13	3.69
1906–1913	3.25	4.13	4.64	5.93	5.86	4.67
1914–1919 . . .	7 47	9.40	11.63	15.45	20.09	11,87
1917	8.49	10.86	12.72	18.04	22.14	13.48
1918	11.45	14.79	19.38	26.29	36.91	19.51
1919	9 61	12.44	16.03	18.66	27.40	15.54
1901–1919	4.47	5.56	6.34	8.46	10.44	6.69

The present publication gives the total agricultural income including the household income per farm, per hectare and per day's work of the family. Table X gives the summary

Given the needy condition of the Exchequer, the amount of the agricultural income is of great importance at the present time, both to the agriculturalists themselves, and to the authorities. It should be remarked that as calculated above, it includes not only the income of work properly so-called, but also the interest on the income engaged in agriculture. It is therefore necessary, when taxing work, to differentiate between these two elements, and only tax what is really work. It must further be mentioned that the figures given refer to the whole farm, and not to a single individual; now, an entire farm occupies, on *an average,* from 1.5 to 2.5 adult members of the family. The authors also lay great stress on the fact, that in levying the tax, these figures must be used with the greatest caution.

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If they are employed for this purpose due regard must be paid to the system of cultivation, the class of produce, the debts contracted, and the number of workers in the family.

The agricultural income of the farmer, not counting the household income, is given in Table XI.

Compared with 1918, there were the following falls in 1919.

	Per cent.
Net return	43.7
Net income	57
Remuneration of work	33.8
Agricultural income	23.3

(7) *Conclusions.* — The year 1918 gave results favourable beyond all expectation. The cost of production increased, but its effects were more than counterbalanced by the larger gross returns realised in every branch of agriculture. Prices rose considerably higher than in 1917, but nevertheless, the produce of the soil was more in demand than it had ever been before the war. The agriculturist had every reason to be satisfied; the vintage was more abundant then it had been for many years, and the wine fetched high prices. Good returns were also obtained from bee-keeping. The price of cattle gave great encouragement to the breeder. By a fortunate coincidence, the factors were all favourable to the net returns which rose to 15 % of the agricultural capital. The year 1918 was a record one for Swiss agriculture.

TABLE IX. — *Agricultural income without household income.*

(in francs).

Years	Farms					General average
	very small	small	average	large	very large	
			Per Farm:			
1908–1913	1673.10	2809.00	3902.80	5085.40	5548.45	3489.45
1914–1919	3529.60	6031.90	10379.80	11514.10	17613.55	8148.80
1917	4417.30	6933.15	9469.95	13618.90	20606.20	9325.75
1918	5757.05	9948.70	14350.90	19565.65	31446.05	13605.45
1919	4128.45	7779.65	10915.25	13332.00	23060.30	10070.70
1908–1919	2601.05	4420.45	6307.75	8299.75	11581.00	5819.10
			Per Working-day.			
1908–1913	3.56	4.55	5.24	6.91	6.32	5.35
1914–1918	7.90	10.08	12.66	17.20	22.50	12.83
1917	9.06	11.90	13.82	20.42	24.27	14.17
1918	12.38	15.92	21.21	29.52	42.01	21.43
1919	9.84	12.92	17.11	19.86	29.82	16.43
1908–1919	5.63	7.31	8.75	12.05	14.42	9.09

In 1919, the first step was taken on the downward path The field crops were light, there were few grapes, the cattle returns were low, and it was only due to the high prices of milk and pigs that the gross returns were but 7.25 % lower than in the preceding year, though the working expenses rose by 26 %. The cost of labour was increased to a special degree, and the current working expenses, amount of depreciation and subsequently, other costs, followed suit. The retrograde movement of the returns must be attributed to the twofold influence of the fall in gross returns, and the rise in the working expenses, which were responsible respectively for $^2/_3$ and $1/3$ of the decrease in the net returns of 1918, though the former increase, and the latter decrease, with the size of the farm.

The agricultural results obtained in 1919 should, however, be regarded as satisfactory, but it is to be foreseen that the fall in returns will continue, and become still more marked, owing, among other reasons to the spread of foot-and mouth disease.

AGRICULTURAL INDUSTRIES

854 - **Studies on Fruit Wines.** — MULLER-THURGAU and OSTERWALDER, U.: I. — The Influence of the Stage of Ripeness of the Fruit upon the Acceleration of the Fermentation Due to the Various Nitrogenous Compounds. — II. — The Importance of Blending Musts in Order to Preserve Fruit Wines. — III. — Cellar Experiments to obtain Pure Fermentation and to Preserve Fruit Wines. — IV. — Lactic Fermentation appearing in Fruit Wines after the Complete Fermentation of the Sugar. — Reprint from the *Landwirtschaftlichen Jahrbuch der Schweiz*, 1920, p. 62. Lucerne, Keller and Co., 1920.

I. — The juice obtained by pressure from 4 varieties of pear (Theilersbirne, Schweizer Wasserbirne, Marxenbirne, and Sürlerbirne), when green, ripe, and over ripe, with or without the addition of ammonium, chloride or carbonate, was left to ferment in the presence or absence of pure yeasts.

The ammonium salts (in the proportion of 0.4 gm. per litre of juice) were found to accelerate the fermentation, thus confirming the results previously obtained (Untersuchungen über die Einwirkung von Stickstoffzusätzen auf die Gärung von Obstwein, *Jahrbuch der Schweiz*, 1917, pp. 44-98). In the case of the unripe pears, the acceleration was less than in that of the ripe fruit, so that it may be concluded that the juice of the former contains more assimilable nitrogen than that of the latter. In all the cases, the fermentation proceeded slowly, but on the addition of pure yeasts, the juice of the green pears fermented at least as quickly as the juice of the ripe pears, for the high tannin content of the unripe fruit had no perceptible retarding effect. The juice of green pears, especially if nitrogen salts are present, ferment completely in a fortnight when pure yeast is added. This rapid fermentation prevents the deleterious action of other ferments which are naturally present (for instance, *Saccharomyces apiculatus*), and often occur in large numbers in the juice.

III. — Fruit wines, particularly those containing little tannin and of a low degree of acidity, usually require more careful treatment in the cellar than grape wines.

A common disease of fruit wines is characterised by the formation of lactic and acetic acid, and contrary to what occurs in ordinary acetic fermentation, it cannot be stopped by the exclusion of air. The best preventive measures are as follows: 1) Rapid fermentation by means of the addition of pure yeasts and ammonium salts; 2) the avoidance of high temperatures. When the fermentation is finished, it is advisable to treat with sulphur dioxide or metabisulphite, in order to prevent the appearance of disease.

IV. — Another clearly defined disease, accompanied by the formation of mannite and of lactic and acetic acids, is caused by *Bacterium mannitopoeum*. During fermentation, the above-mentioned acids and other volatile acids are produced at the expense of the sugar, but as soon as the fermentation is finished, they can also be formed from the glycerine and other extractive substances.

II. — In order to prevent the occurrence of the disease in juices deficient in acidity, and with too low a tannin content, it is advisable to mix them before fermentation with the juice of pears or apples rich in acids and tannin. The attempts at correction by adding pear-juice with a high tannin content alone did not give wholly satisfactory results. The juice thus corrected should be fermented as soon as possible by means of the above-mentioned processes, and treated with sulphurous acid when the fermentation is terminated.

855 – Sudden Physiological Changes in Lactic Ferments Due to Individual Divergences.

— GORINI, C., in the *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 22, pp. 1382-1384. Paris, May 30, 1921.

As the author stated in 1892, certain lactic ferments, called by him " acidoproteolytic ", have the power of rendering soluble the casein in an acid medium, hence the part assigned to them in the ripening of cheeses. This property is not always easily detected, and has often been unrecognised.

In a series of articles (1), the author has shown that the double saccharolytic and proteolytic function of these ferments shows variability and irregularity according to their conditions of life (temperature, aerobiosis, the quality of the medium, and especially that of the milk, etc.), caseolysis being chiefly noticeable in cultures at low temperatures (20° and 25° C.) in the presence of air, and in milk that has been moderately sterilised (not in the autoclave, but by the Tyndall process) so that it still retains its white colour.

Recently, the author has discovered that, in addition to transitory variations in their behaviour connected with external factors and with the *modus operandi*, these ferments also show abrupt, spontaneous and transmissible changes in their mode of action.

He has observed that, whereas normally lactico-proteolytic ferments first coagulate milk, and subsequently re-dissolve the curd, sometimes, though very rarely, a certain variety of the ferment always peptonises the milk in an acid reaction, without, however, previously coagulating it; this modified action is transmitted to its descendants.

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(1) *Atti della Reale Accademia dei Lincei*, Roma, 1910 to 1921, *passim*.

The author has also met with cases of "retromutation" that is to say, a sudden return after several generations, from these deviations to normal behaviour; the change, however, does not take place in the whole culture, but only a portion of it is modified.

For this reason, is order to explain these phenomena of sudden mutation, the author has recourse to the hypothesis of individual divergence brought forward by Charles RICHET to account for the irregularity of the behaviour of a lactic ferment in the presence of toxins. In fact, it is only logical to suppose that, amongst cells endowed with a two-fold saccharolytic property, some must be chiefly saccharolytic, and others chiefly proteolytic, and when it chances to occur that the sowing consists exclusively, or almost exclusively, of spores of the same type, a sudden divergence takes place, which is perpetuated by heredity, until by accident, a set of spores happen to be sown, which give rise to cells possessing both qualities in equal proportions.

The more favourable the cultural conditions, the more numerous the sub-cultures, and the shorter the intervals between them, the greater the number of spores taken from the whole thickness of the parent culture, and sown, the less apparent and less frequent are these modifications. Nevertheless, in spite of every precaution, these mutations inevitably occur, even under the most eugenetic conditions, and are not merely the result of unsuitable environment, as some authors believe.

The theory of individual divergence would also explain certain doubts in the determination of different types of various milk bacteria (*Streptococcus lacticus*, teat coccus, etc)

In fact, it substitutes for the idea of the plurality of species, races, types and varieties, the conception of a single species with variations connected with the normal differences present in individual cells In this manner, the classification of lactic ferments, which tended to become unduly complicated, is at once simplified.

856 - **Does Any Correlation Exist Between the Fineness of Wool Fibres and the Number of Undulations?** — VOITZ, in *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, Year XXXVI, No 22, pp 339-340, tables 2 Berlin, May, 1921

The author, from a further study of the question, using the data obtained by W. VON NATHUSIUS as basis, as well as his own observations, states that in many cases, especially in Merino combing-wool poor in yolk, there is no correlation between the fineness of the fibre and the diameter of the undulations. NATHUSIUS offered no explanation of the fact that equally fine wools may have very different undulations. According to the author's observations the development of a very fine fibre with coarse undulations is due to the following factors:—

1) The more elongated shape of the spiral sheath of the bulb.

2) In wools with little yolk, the fibre encounters but slight resistance in the strand (*Strahnchen*).

3) One or more coarser straight hairs in the strand draw out the adhering fibres.

4) The reduced elasticity of the wool.

In the following Table, the author gives the qualities of the different wools calculated from the diameter of the fibres, and the undulations. Thus the diameter of the undulations is no index of the fineness of the fibre. For this reason, the author lays much stress upon the necessity of measuring the fineness of isolated fibres as accurately as possible with a micrometer, in order to avoid all errors in determining the quality of a wool, especially if the fibres are very fine, and coarsely undulated.

	Sample of wool No.	I		II	
		Diameter of fibre μ	Quality	Undulations mm.	Quality
W. von Nathasius	25	15.3	AAAAA	1.76	C
	16	15.4	AAAAA	1.50	B_1
	17	16.9	AAAAA	1.61	B_2
	14	17.9	AAAAA	1.28	A
	13	20.2	AAA	1.50	B_1
	18	20.7	AAA	1.55	B_1
	15	22.1	AA	1.46	B_1
	21	22.1	AA	2.00	C
	26	22.4	AA	2.60	E
	19	27.6	B_1	2.03	D
	20	28.1	B_2	1.61	B_2
	22	31.4	C	2.76	E
	23	34.0	C	8.60	F
	24	41.6	D	20.10	F
Völtz	Merino Ram . . . shoulder-wool . .	22.0	AAA	1.26	A
	Merino Ram . . . shoulder-wool . .	21.8	AAA	1.80	C
	Early merino ram shoulder-wool 1 .	19.7	AAA	1.82	C
	Early merino ram shoulder-wool 2 .	21.5	AAA	2.85	E
	Early merino ram shoulder-wool. . . .	21.1	AAA	2.85	E

857 - **The Cold-Storage of Fruit.** — MONVOISIN, A., in the *Revue général du Froid et des Industries frigorifiques*, Year II, Vol. II, No. 3, pp. 80-85. Paris, March, 1921.

The author, who is the Head of the Physical and Chemical Department of the Alfort School, and lectures on the preservation of perishable articles of food before the French Cold-Storage Association, writes a summary of the facts, so far as at present known, as regards the cold storage of fruit.

I. — CHOICE OF FRUIT TO BE PRESERVED. — Since cold storage is relatively expensive, it is in the first place necessary to select fruit that, after the normal period of storage, will have sufficient market value to ensure a reasonable profit, and can for instance be put on the market in winter, when there is a scarcity of fresh fruit. The amount sold should bear such a proportion to that stored, as to prevent the waste unduly increasing the net cost.

In the choice of fruit for cold storage, it is necessary to take into account: — *a*) The nature of the fruit; *b*) its place of origin; *c*) its degree of ripeness; *d*) its individual qualities

a) *Nature of the fruit.* — Only fruits of best quality should be used. Naturally the fruits of late autumn are principally chosen. For this reason, the cold storage of peaches is not profitable, since they have reached the limit of their keeping powers at the time when the market is abundantly supplied with grapes, pears and apples.

Different varieties of the same fruits do not behave alike during cold storage; some pears, for instance, cannot remain over a month in the cold chamber, whereas, in the case of others, only a few are spoiled, even after four months.

b) *Origin of the fruit.* — The soils of the orchards, by affecting the composition and constitution of the fruits, have also considerable influence upon their keeping qualities.

There seems to be little difference between orchard fruit and that of scattered trees growing in fields. The fruit of trees on damp soil does not keep as well as that of trees growing on fairly well-drained soil. Nevertheless, LÖHNIS has found that fruit from sandy soil often keeps badly

According to POWELL, the older the trees, the better the fruit keeps.

The influence of the climatic conditions during the growth, and especially during the ripening, of the fruit is very great, but differs with the variety under consideration.

c) *Degree of ripeness.* — The degree of ripeness of the fruits when gathered depends upon the variety, and also, to some extent, upon the storage period. The nature of the soil and climatic conditions can also determine the date of picking.

As a general rule, the fruit should be gathered a little before it is quite ripe, for otherwise it would be necessary to eat it either at once or after a short journey. Stone-fruit can be picked riper than fruit with seeds.

Firm fruits that are well-coloured keep better in the cold chamber than less ripe fruit, which would be expected to stand preserving better. This is clearly shown, in the case of 6 varieties of apple, by the experiments of RAMSEY MAC-KAY, MARKELL, and BIRD.

TABLE I. — *Results obtained with "Rome Beauty" Apples.*

	Total loss in hundredths			
Length of preservation at 0° C.	On leaving the Cold Storage Dépôt		Ten day after leaving the Cold Storage Dépôt	
	Normal ripeness	Unripe	Normal ripeness	Unripe
3 ½ months	0	1.1	1.9	50.5
4 ½ months	0	20.5	0.2	70.5
6 months	1	49.1	12.0	91.3

Over-ripe fruit should not be placed in cold-storage, for the loss incurred is great, as is shown by Table II, the figures having been obtained by the same authors with " Esopus " apples ; at a temperature of 0° C.

TABLE II. — *Results obtained with the " Esopus " Apples.*

Length of Storage at 0° C.	Total Loss in hundredths Normal ripeness On leaving Cold Storage Depôt	 Normal ripeness Ten days later	 Lot gathered 15 days later On leaving Cold Storage Depôt	 Lot gathered 15 days later Ten days later
[illegible] ½ months	0	1.3	2.3	2.3
4 ½ months .	0	1.3	9.1	25.0
6 months	1.3	2.7	4.0	26.0

d) Individual qualities. — Fruits to be placed in cold storage must be subject to severe individual examination, and only sound and perfect specimens should be used.

II. — TREATMENT OF THE FRUIT BEFORE STORAGE. — This consists of *sorting* and *packing*.

Sorting is absolutely indispensable, not only in order to weed out the fruits which show signs of rapid decay, but for the purpose of grading them according to size, colour, and ripeness In the case of oranges, the operation is sometimes preceded by washing, but the results are unsatisfactory and the cleaning of these fruits, if necessary, must be carried out by brushing them while dry. STUBENRAUCH, RAMSEY, and TENNY found the losses after only a fortnight's storage at 0° C to be as follows. — Unwashed oranges, carefully gathered and packed, 1 %; treated according to the usual commercial methods, 3.6 %; washed oranges, 4.1 and 10.2 % respectively.

The packing-cases should be adapted to the nature of the fruit they are to contain, the length of storage and the amount of handling to which they are to be subjected They must be strong, and at the same time not unduly heavy, and should allow of the air circulating freely inside them. As a rule, these cases are made of osiers or wood, and sometimes of ordinary or corrugated cardboard.

Delicate fruit, such as strawberries and choice grapes, are generally put in to small hampers or baskets (" fleins "), which only contain 3 to 5 kg., and are themselves placed to the number of 4 or 6, in larger receptacles, or " cageots ". As these fruits are too delicate to be allowed to come into direct contact with the packing-cases, these are lined at the bottom with a small elastic cushion formed of strips of paper, or wood-shavings, covered with a sheet of tissue paper ; cotton may also be used.

Choice fruits of a certain size (pears, apples, peaches) are packed separately in boxes with compartments, or with movable divisions made at the time of packing

They are sometimes placed in a small mass of shreds of paper, which is usually coloured, in order better to show off the hues of the fruit. Such fruits are generally packed separately, each one being wrapped in a sheet of thin paper Such a covering is of advantage, especially in the case of varieties with thin skins and delicate flesh. Air-tight packing has its disadvantages when the fruits are delicate, for their flavour and aroma is quickly deteriorated by remaining long in an atmosphere charged with carbon dioxide.

Cork waste, or wood sawdust, are used for packing tomatoes, and grapes. In such cases, the fruit is always put in deal barrels.

Fruit requiring less care, such as winter apples, are as a rule, put without any special care in large barrels

III. — GENERAL REMARKS RELATING TO THE COLD STORAGE OF FRUIT — Sometimes the store-rooms are heated to hasten the ripening of certain fruits, whereas on the other hand, cold is applied to retard ripening, or to prevent any change taking place for some time in fruits that are already mature

Cold is applied in two ways; chilling is the most useful and widely practised method, while freezing is resorted to in the United States

A Chilling. 1) *Method of chilling.* — The best method is by the circulation of brine, provided it is so arranged that the air of the room can be completely changed.

2) *Temperature* — The intensity of the cold depends upon the fruit to be preserved, its degree of ripeness, and the length of storage The temperature ought, as a rule, to be kept at about 0° C., except in the case of bananas (details are given later). The temperature should be maintained as uniform as possible, with daily deviations not exceeding 1°C. To raise the temperature above the given limits has the disadvantage of hastening the ripening of the fruit, and thus shortening the time it can be stored. A fall in temperature may cause freezing and the loss of some of the stock It must be remembered, however that the freezing-point of fruits is lower than that of water, on account of substances dissolved in the cell-sap, such as organic acids and especially sacchariferous matters.

It is in order to prevent freezing that the circulation of the air must be well regulated, and that so-called wet refrigerators cannot be used

On account of the combustion due to their respiration, the temperature of the fruits is always above that of the cold chamber in which they are kept. The average difference is 1°C., though it may vary from 0.5°C to 1.5°C.

Some fruits, especially apples, can resist a slight amount of freezing for a short time, such as a day, if they are thawed slowly and gradually, first to −2°C. and then then to −1°C.

3) *Immediate cold storage* — Fruits of normal ripeness should be put into cold storage as soon as they are picked, and before any alteration has had time to set in. This precaution is all the more necessary if the fruit has been gathered during the heat of the day, and when the temperature out of doors, is very high. The temperature of fruits at the mo-

ment of picking is always higher than that of the atmosphere; the difference may be as much as 8° C. and 9°C. during the hot hours of the day.

Experiments carried out on many kinds of fruit in Canada and the United States show the great importance of immediate cold storage as compared with delaying the treatment until several days after gathering.

TABLE III. — *"Rome Beauty" Apples; Loss after preservation at 0°C. for three months and a half*

	Loss in hundredths	
	On leaving the cold-storage chamber	Ten days after leaving the cold-storage chamber
Placed in cold storage: —		
Immediately after picking	0.3	13.8
A fortnight after picking	0.6	21.1

TABLE IV. — *Oranges preserved at 0°C.*

	Loss in hundredths Time that elapsed between picking and cold-storing		
	1 day	3 days	4 days
Sound oranges, brushed	0.1	2.3	3.4
Sound oranges, washed	0.9	2.3	5.5
Oranges treated commercially	2.3	6.2	9.1

The fruits placed at the depot take a variable time (according to their size and the way they are packed) to reach the temperature of the treatment. The time required is shorter, the lower the temperature of the air, and an attempt has been made in Canada to bring the fruit rapidly to the cold-storage temperature by placing them for a short time, and with careful supervision, in a chamber at from —9°C. to —10°C. Under these conditions, the fruit is chilled in 4 to 7 hours, instead of requiring one or two days. The advantage of this quick chilling, from the point of view of the preservation of the fruit, is, however, not very clear. It is, advisable, however, in the case of small fruits with thin skins, such as strawberries and gooseberries, as has been shown by HAWKINS and SANDO for it prevents the skin from breaking, and also renders the fruit less liable to bruise.

4) *Hygrometric condition.* — This should be as constant as possible, and is generally kept at between 70 and 80 hygrometric degrees according to the variety of fruit.

If the water-content of the air falls below 65, or even much lower than 60 hygrometric degrees, it induces too rapid evaporation, a perceptible loss of weight, and dries up the epicarp, which becomes wrinkled, owing to the shrivelling of the fruit. Even if the flavour remains unimpaired, the appearance of such fruit greatly reduces its market value.

The increased moisture of the air, even if it rises to about 85°, or even 90°, is of much less importance, if the temperature is low (between — 0.5°C. and + 0.5°C.) than if it rises to about + 2°C. or + 3°C.

5) *Reneaal of the air.* — The atmosphere should not contain much carbon dioxide, both for the sake of the workers handling the fruit, as well as for the fruit itself. For this reason, and also in order to ensure uniformity of temperature, the cases of fruit ought to be so arranged, that there is a free circulation of air around and inside them. The passages left to enable the stored fruit to be easily inspected also promote proper ventilation.

In any case, the air of the chambers must be renewed about once a day at the beginning of storage, and oncea week subsequently. The opening of the doors in the course of handling the cases, is often sufficient to ensure aeration. Should it not prove to be so, it would be necessary to have recourse to artificial ventilation; the current must be slow and well regulated, in order to prevent any chance of freezing.

6) *Inspection of the stock.* — The stored fruits must be examined every fortnight, or every month, according to their nature and the condition they were in when put in cold storage. In this way, any fruits that are becoming rotten can at once be removed, which sometimes prevents the loss of a large quantity, and also enables the fruit to be sold gradually as it becomes ripe .

7) *Removal from the cold chambers.* — If the fruit is removed with a view to taking it for a long distance, either for immediate consumtion, or re-storage, it should be place in a separate truck, in order to prevent the temperature rising after loading. Fruit intended for immediate consumption must not at once be subjected to a high temperature. As a rule, it is removed from cold storage during the winter, when the exernal temperature is relatively low. The condensation of water-vapour is little to be feared, and the moisture is absorbed by the packing-material. If the external temperature be high, the fruit must be left for at least. ten or twelve hours in a room at a temperature of about + 6°C.

Fruit keeps better when removed from the cold-storage depôt into the outer air, if it has been preserved at 0°C , than if the temperature has been kept at + 2°C or +4°C.

Table V gives the losses sustained in the case of the removal of Esopus apples from the cold chamber as estimated by RAMSEY, MACKAY, MARKELL and BIRD.

IV. — CHANGES OBSERVED DURING PRESERVATION. — These alterations are due to evaporation, physiological processes, or supervening bacterial action. They are either physical, chemical, or bacterial.

a) *Physical changes.* — These consist in loss of weight, alterations in texture or appearance, or loss of aroma.

TABLE V. — *Losses in Esopus removed from the cold chamber.*

Duration of Storage	Proportion of spoiled apples expressed in hundredths			
	at 0° C.		at +2° C	
	On leaving the depot	Ten days later	On leaving the depot	Ten days later
3 ½ months	0	0.7	0.7	8.4
4 ½ months	0.6	2.9	4.8	11.9
6 months	10.1	12.4	13.9	17.4

1) *Loss of weight.* — Loss of weight is caused by the united effects of water-evaporation and the combustion of certain substances resulting from the respiration of the fruits. This loss is more marked when the fruit is preserved at high temperatures, and the air frequently renewed. Thus, TRUELLE estimated the loss in weight in the case of Grosse Grise pears from the Auge Valley, that had been knocked down from the trees and preserved under usual conditions at the ordinary temperature to be as follows :—

Initial weight.	1 000 kg.	
Weight after 15 days	936 kg., or loss of	6.4 %
» » 30 »	887 » » » »	11.3 %
» 45 »	836 » » » »	16.4 %
» » 60	791 » » » »	20.9 %
» » 75	495 » » » »	50.5 %

At the temperature maintained in the cold-storage depots, under the above conditions, the loss amounted to between 2 and 5 % for the normal duration of storage.

1) *Changes in appearance.* — When there is great loss of weight, the volume of the fruit decreases, and the epicarp, not being able to adjust itself to the variations in volume, becomes wrinkled.

When the alteration in the fruits is due to rotting, or to the fact that they were placed in cold storage at an unsuitable stage of ripeness, certain parts of the epicarp, usually the uncoloured portions, turn black. When the change is more advanced, the fruit on being cut, reveals a dark brownish coloration of the underlying portions. At this level, the tissues of the pulp, which were very firm at first, become soft and are soon transformed into a brown pap.

These changes generally affect a considerable part of the surface of the fruit. Other alterations take the form of small circumscribed areas, sometimes clearly defined, of a brown, or blackish, colour.

The common affection of oranges, due to the invasion of the pericarp by a species of *Penicillium,* is soon revealed by the appearance of the green fructifications of the fungus.

The " sleepiness " of acid fruits, which cannot be detected by inspection and feeling, is shown when they are cut, by the liquefaction of the pulp in the neighourhood of the pips; this pulp, which was previously ligh brown, soon takes on a dark coloration. Like all other changes, "sleepiness" appears more quickly the higher the temperature at which the fruit is preserved. In the case of Grosse Grise pears under ordinary storage conditions, TRUELLE found that "sleepiness" did not manifest itself till about the 45th day.Towards the 60th day, 3/4 of the stored pears are "sleepy," and ¼ rotten.

3) *Loss of aroma.* — This is undeniable after the fruit has been in cold-storage for a certain time, sometimes it occurs even at the end of a month. As a rule, the aroma is not appreciably affected until the fruit, peaches for instance, has been at least two months in cold-storage.

b) *Chemical changes.* These are the alterations occuring during the normal process of ripening, with the sole difference that their rapidity is considerably lessened. This is clearly shown by comparing the results obtained by BIGELOW with the Ben Davis apple, which was preserved for 133 days at 0°C., and also at ordinary temperature.

TABLE VI. — *Results obtained by* BIGELOW *with the Ben Davis apple.*

	At the beginning	Preserved 133 days	
		at ordinary temperature	at 0° C.
Total dry matter	15.40 %	13.02 %	14.21 %
Acidity expressed as malic acid.	0.63	0.33	0 50
Saccharose	3.83	0.90	2.25
Total sugars (in invert sugar)	10.17	8.57	9.46

The loss in weight is more noticeable at ordinary temperature than at 0°C. The combustion of the acids, although perceptible, is less pronounced at 0°C. than at ordinary temperature; the same may be said respecting the combustion of sugars.

The results obtained with other fruits such as peaches, plums, etc., are very similar to those observed in the case of apples.

c) *Bacterial changes.* — These are due to the penetration through the unbroken epicarp, or more frequently through lesions on its surface, of spores deposited on the outside of the fruit during its growth, or in the course of the handling it has undergone.

B. — *Freezing.* — In the United States, certain fruits used in making side-dishes, confectionery, effervescing drinks, and ice-creams are preserved by freezing. The fruits thus treated are strawberries, mulberries, black currants, raspberries, cherries, gooseberries, plums, and whortle-berries.

These are put into ordinary cases, if they are to be preserved for a short time, or into little boxes of waxed cardboard. As soon as possible after picking, the fruit is placed in a cold chamber kept at a temperature varying from —12°C. to —19°C.

The fruits are frozen at the end of 24 or 48 hours and remain, until the time of using, in the same chambers, the time varying from 4 to 10 months. They must be used at once after thawing.

When the fruit has only to be kept for a short time the aroma is better preserved by subjecting it to the action of heat, or by desiccasion.

It has recently been proposed to freeze apples in a salt freezing-mixture.

V. — DETAILS RELATING TO THE COLD STORAGE OF THE PRINCIPAL FRUITS. — *Apples.* — These, as a rule, keep very well in cold-storage. Sound fruit, picked when nearly ripe, should be chosen. The Grey Golden Reinette, Autumn Grey Reinette, and Orleans Reinette cannot stand being kept long in a cold-chamber.

The case in which the fruit is packed varies with the quality of the apples to be treated.

The temperature may vary between — 1°C. and + 2°C., with 85 hygrometic degrees. Apples can even be kept in an atmosphere of 90 hygrometric degrees Under these conditions, the fruit can stay in cold-storage for a year, and even two years.

The loss of weight during 3 to 6 months' cold-storage varies from 2 to 5 %.

Apples have little to fear from freezing; they usually freeze at about — 3°C., ; if they have frozen for a short time at about — 4°C., they take no harm, provided they are thawed slowly at — 2°C, and — 1°C.

Pears. — These also stand cold-storage very well; as in the case of apples, autumn and winter varieties should be selected Choice pears are packed in small cases, or placed in a single, rarely a double, row.

The conditions of temperature and moisture are the same as for a apples.

The Beurré d'Amanlis, and Bonne Louise varieties can be preserved for 3 months, Williams, Duchesse d'Angoulême, and the Curé for 4 months, and Beurré Clairgeau for as long as 6 months.

Peaches. — The cold-storage of peaches might be useful to the export trade. They should be picked when well coloured, but still hard, and packed, one row deep, in small wooden cases. The best temperatures for short transport are from + 6°C to +8°C. They should be placed in cold-storage at from 0°C to 1°C., the moisture content of the air being 85°. Peaches lose their aroma after 6 months cold-storage, an appreciable decrease being noticeable at the end of 2 months.

Strawberries. — These must be picked carefully when they are well-coloured, but hard. They are packed in hampers, which are placed, to the number of 4,or 6, in cases. At a temperature of — 1°C., in an atmosphere of 90 hygrometric degrees, strawberries of a proper ripeness will keep well for four, or even, five weeks.

Bananas. — The fruits of cultivated bananas weighing on an average 70 gm. consist of about 25 gm of skin, and of a farinaceous pulp weighing nearly 45 gm. The sugar content of this starchy pulp increases progressively as the fruit ripens, and when the banana is quite mature, it may contain as much as 15 to 20 % of its own weight of saccharose. The weight of bunches of large bananas ranges from 20 to 35 kg., and the number of fruits they contain varies from 100 to 250.

The bunches of bananas are wrapped up in a cotton leaf then in paper, or in banana leaves, and placed, one or two in number, according to their size, in crates usually octagonal in shape.

Bananas are characterised by their great sensitiveness to low temperatures. At 0°C, + 5°C., and even +6°C., the fibrous pericarps quickly becomes discoloured and black, which detracts greatly from the marketable value of the fruit.

In order to keep them green, and prevent ripening, bananas are kept in cold-storage at a temperature of + 8°C. This is raised to + 12°C to make them ripen gradually, the hygrometer being at about 70 degrees. They finish ripening in the store of the retail dealer, where the temperature should be kept at from 18°C. to + 20°C.

858 - **Observations on the Evaporation and Dehydration of Fruits and Methods Employed in California.** — I CRUESS W. V., Observations on the Evaporation of Pears, Prunes and Figs, *Monthly Bulletin of the Department of Agriculture State of California*, Vol X, No 2, pp 88-93 II. CHRISTIE A. W, Some Observations on the Dehydration of Apricots, Peaches and Grapes, *Ibid*, pp. 94-96 Sacramento Ca, Feb 1921

Report of investigations carried out by the Division of Fruit Products during the 1920 season. Data were accumulated both from commercial scale tests and from the University Farm Evaporator and from visits to most of the dehydrators in operation in the State of California.

I. — *Pears*: — Small scale laboratory tests were made in the Fruit Products Laboratory at Berkely. and 6 ½ tons were dried in the two commercial size evaporators on the University Farm Davis.

Pears were ripened in boxes in the shade, in straw with a layer of straw between each layer of fruit and on 3ft. screen bottom trays stacked in the shade about 30 trays high. The fruit in the screen trays did not ripen quite so evenly or rapidly as that in the straw.

As regards the preparation of fruit for drying, the best results were obtained by first peeling the fruit, before cutting in half and before it is too ripe, (it has been found that pears may be satisfactorily lye peeled in the spray type of lye peach-peeling machines) The author also recommends the removal of the core, and the sprinkling of the trays with a dilute salt solution and then a 3 hours sulphuring before proceeding with evaporation. He does not consider steaming an essential part of the process. Slat-bottom trays were far more satisfactory than screen trays which became badly corroded in the sulphur fumes and imparted a strong metallic flavour to the fruit.

With reference to sun-drying versus evaporation, the yield by the former was slightly greater than in the evaporator, but the latter contained less water. Although pears will withstand temperatures up to 145°F, the best results were obtained by drying the fruit until about $^2/_3$ dry at 140°F, followed by 110°F. It is also much easier to maintain a high relative humidity at 140°F. (30° is satisfactory) In the laboratory test, pears required over 40 hours to dry in air of low humidity, while only 27 hours were required with air of high humidity. The fuel consumption at the University farm was 42½ gallons of store oil per green ton of fruit and the drying ratio 4.5 : 1.

Prunes. — Somewhat surprising results were obtained in the drying of undipped prunes in comparison with dipped fruits. In the evaporator in which natural draught is relied upon for air circulation or in which the air flow is very slow, the fruit which was not dipped dried just as rapidly as the dipped fruit. In evaporators in which a strong blast of air was used the latter dried much the more rapidly of the two. No explanation is offered at present for these observations.

The author found that a temperature of 160°F at the start of drying and a finishing temperature of 145°F gives good results, although quite good dried prunes are produced at 165°F. It is believed that 20 to 22% moisture is approximately the proper range. The fruit should not be steamed until it cracks badly (steamed fruit was lighter in colour than dipped fruit). There was no noticeable difference in the yield of dried product from sun drying and evaporation.

Figs. — Calimyrna figs from Merced were dried in an evaporator at Davis. Lot I was dried untreated, lot II was fumigated in sulphur for 5 hours, two hours are however sufficient) and lot III was prepared by slitting the fruit on one side and spreading it on trays.

Lots I a II required 9 hours to dry at 155° and 160°F. Lot III required only 5 hours at the same temperature. From the results of the preliminary experiments made up to the present it appears that it will be feasible to evaporate figs grown in those districts of California where there is not sufficient sunshine to permit satisfactory drying and curing in the sun.

II. *Apricots.* — A 1 hour exposure to sulphur fumes was sufficient to preserve the colour of the dehydrated fruit, whereas 4 to 5 hours was required when the fruit was sun-dried. The time required for dehydration was 12 hours, the temperature of the intake air being 165° to 170°. No injury to the apricots resulted from this temperature. Inadequate air-flow, caused by insufficient horse-power lengthened the drying time. The experiments indicated that an excellent quality of dehydrated apricots can be produced if fully ripened fruit, properly sulphured is used.

Peaches. — The usual drying time for unpeeled peaches was 24 hours while the packed fruit dried in 14 hours ; but this can with adequate treatment, be reduced considerably. The temperature used was about 10° less than for apricots, as a higher temperature tends to scorch the fruit. Experiments demonstrated that high quality dehydrated peaches if dried only when thorougly ripe either peeled or unpeeled can readily be produced.

II III. *Grapes* (1). — Drying has proved to be one of the most feasible method of converting the wine grapes of California into a non-perishable saleable product It is contended by many that a greater yield and a better quality of raisins are obtained by artificial drying in an evaporator than in the sun.

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(1) See *R.*, April 1921, No. 435.

All grapes dehydrated at the University Farm in 1920 were lye-dipped, rinsed, sulphured at least 1 hour and dried at a final temperature of 165°F. The average drying time was 30 hours.

PLANT DISEASES

GENERAL INFORMATION

859 - The Coleopteron *Pissodes notatus* Declared an Insect Injurious to Agriculture in Uruguay (1). — *República Oriental del Uruguay, Ministerio de Industrias, Defensa Agricola, Boletin mensual*, Year II, No. 5, p. 121. Montevideo, May 1921.

In accordance with the recommendation of the Central Commission of of the "Defensa Agri ola" of Uruguay, the " Consejo Nacional de Administración " passed a decree on April 29, 1921, declaring the coleopteron *Pissodes notatus* to be included among agricultural pests.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

860 - " Scottatura " or " Allessatura " (Scald) of Citrus Fruits, in Southern Italy. — SAVASTANO, L., in the *R. Stazione sperimentale di Agricoltura et Frutticoltura, Acireale, Bollettino* 40, pp 4-5. Acireale, 1921.

The winter of 1920-1921 was, generally speaking very wet in South Italy, and the temperature was higher than it had been for at least ten years.

Many cases of scald were observed during this period among the oranges and lemons. Fruits that were already ripe first turned a whitish red, as if they had been dipped in boiling water; this took place very quickly within a day. Afterwards the colour changed to brownish-red and finally to black, and at the end of two or three days, the fruits became detached from the peduncle. For the first few hours, the rind alone is attacked, but later the alteration extends to the interior of the fruit. Usually the disease begins at the navel, and passes upwards, although the side alone may sometimes be affected. The fruits growing lowest on the tree suffer most, those in the centre are rarely attacked, and those at the top are almost immune. The scald begins during the night, so that fruits which were perfectly healthy the evening before, are found to be affected the next morning. The alteration is confined to citrus plantations in the valleys, or on the plains, those situated on hilly land remaining immune.

During the winter 1920-1921, there was much fog in the eastern region of Etna, and scald was so wide-spread, that even the fruits on the top of the trees were affected. In certain very bad cases, as much as 20 %. of the fruit was attacked.

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(1) See *R.*, May, 1921, No. 591. (*Ed.*)

Given the meteorological nature of the affection, it is clear that any remedy is most difficult to find. In the Sorrento plantations the branches near the ground were cut away, but this method was not adopted in Sicily and it is unnecessary in many cases, and even harmful, for if the lower branches are removed, the higher ones develop too much, and thus the fruits are exposed to another danger, of annual occurrence, not incidental like scald, viz., insolation.

861 - **Hypertrophied Spruce Trees Caused by Exclusively Nitrogenous Nutrition.** — See No 797 of this *Review*

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

862 - **Plant Diseases Observed in Morocco.** — MIÈGE, E, in the *Bulletin de la Société de Patologie vegetale de France*, Vol VIII, Part 1, pp 37-46, Paris, 1921.

First contribution to our knowledge of the plant disease recorded in Morocco.

It can be stated that, in general, with the exception of the Uredineae and Ustilagineae, which are very common on a large number of plants, the diseases hitherto observed in Morocco are few and of little importance.

The Uredineae attack many plants, especially cereals, which are the crops most cultivated in Morocco.

Puccinia graminis and *P. glumarum* are frequently found; the hard wheats seem somewhat less susceptible to the attacks of these fungi than the soft varieties, whereas the native barleys (*Hordeum tetrastichum*) behave in a similar manner to the Svalöf varieties (*H. disticon*). *P. Maydis* is found on maize; the different species of *Oxalis*, especially *O. cernua*, which are found plentifully in a wild state are attacked by an uredinea considered by some authors to be the occidial form of *P. Maydis*. *P Malvacearum* is often seen on the numerous Malvaceae infesting the fallow land Other fungi of common occurrence are:— *Uromyces Pisi* on peas and vetches; *U. Fabae* on garden beans; *U. appendiculatus* on kidney-beans; and *U. Anthyllidis* on lupins. Flax is attacked by *Melampsora Lini*, roses by *Phragmidium subcorticium*. The presence of Uredinae has also been reported on castor plants, and Euphorbia. The injury done by these various parasites has, however, been hitherto of little importance.

Cereals, especially along the coast, are much attacked by Ustilaginae: in 1920, *Ustilago Tritici* infested 25 % of certain soft wheats at Rabat. The barleys are attacked by *U nuda* and *U. Hordei*; the latter parasite seems less common than the former. *U. Maydis* occurs more rarely on the female inflorescences, and also in the axils of the leaves of maize; the species of *Sorghum* suffer little from fungi. *U. Cynodontis* lives on *Cynodon Dactylon* which grows abundantly on the sandy soils of the coast region. Species of *Tilletia* are not very widely distributed, nevertheless the hard wheats of several districts are attacked by what is probably *T. Tritici*.

Phytophthora infestans attacks the potato, but this plant suffers perhaps more from a disease characterised by large, brown, very well defined patches, which appear on its terminal leaves, and soon deform them (*Sporidesmium*).

Asterocystis radicis has been found on flax.

Ascochyta Pisi is not rare on a certain number of Leguminosae.

Gleosprorium caulivorum has been seen on wild clover.

Armillaria mellea is chiefly found on land that has been much irrigated, or liberally manured.

Plasmopara viticola, and *Oidium Tuckeri* have been noticed on some vines, but native stocks seem endowed with a considerable degree of immunity, while the European varieties, taken as a whole, are rarely seriously injured by the attacks of these parasites.

Diseases of bacterial origin are not infrequently met with on ligneous plants, specially olives and almond-trees, and in 1920, even carnations were similarly affected.

As regards indeterminate diseases, one which seems chiefly to infect Leguminosae (beans, peas, and chick peas), has been discovered in several localities, where it causes a good deal of mischief. It chiefly invades the root-collar and the base of the stems, but it may descend to the tap-root, or even ascend to the epigeal organs, which become covered with patches of the colour of wine-dregs, or of a brown tint and then dry, and split, after which the plant dies.

Another disease, which has not been identified, has been reported as attacking potatoes growing on experiment plots.

863 - **Seed-Coat Injury and Viability of Seeds of Wheat and Barley as Factors in Susceptibility to Moulds and Fungicides.** — HURD, A. M., in *Journal of Agricultural Research*, Vol. XXI, No. 2, pp 99-122, pl II Washington, D C. April 15, 1921.

The saprophytic fungi that infest both soil and seed are serious enemies to successful wheat and barley culture.

The authors experiments have shown, that an unbroken seed-coat ordinarily offers absolute protection against attacks of living seeds by *Penicillium* sp. or *Rhizopus nigricans* in damp storage, in the soil, or in the blotting-paper germination. Infection of such seeds has, however, been obtained by retarding germination by means of low temperatures.

The location of a break in the seed coat determines the ability of saprophytic fungi to invade seeds in the soil, in storage, or in laboratory (blotting-paper) experiments. If the injury is over the endosperm, 100 per cent fatal infection results when spores of *Penicillium* or *Rhizopus* are present, but if it is over the embryo, the seeds remain practically immune.

The vitality of seeds is a factor in determining the power of *Penicillium* and *Rh. nigricans* to attack them Death, or injury, resulting from seed treatment, or other cause renders previously immune seed immediately susceptible. Even perfect seed coats are no longer a protection.

No visible infection with either *Penicillium* or *Rhizopus* occurred when the temperature remained as low as 10°C., throughout the experiment.

Penicillium sp. requires an atmospheric humidity of at least 80 per cent for its development on stored wheat. *Aspergillus* sp. develops with 70 % atmospheric humidity.

These moulds develop more slowly on stored wheat and barley which has been treated with copper sulphate, or formaldehyde, than on equally moist, untreated wheat.

Although a break in the testa over the endosperm of wheat does not result in any injury to the embryo upon short exposures to copper sulphate, injury becomes apparent after exposures of an hour, showing that the poison is eventually absorbed through the endosperm and scutellum. A similar break over the embryo results in its death after exposures of only 3-5 minutes.

When the seed coat is badly injured, liming does not prevent fatal consequences, because the copper sulphate enters such seeds quickly. When the seeds are only slightly injured, a lime dip is effective in neutralising the solution before any bad effects manifest themselves.

Stunted roots, rather than injured plumules, are characteristic of the toxic effect of copper-sulphate, because machine-thrashing usually breaks the seed coat directly over the radicle.

The damage that will be done to wheat seed by the copper sulphate treatment and by saprophytic fungi can be pradicted by examination of the physical conditions of the seed. All these troubles can be reduced by greater care in thrashing the seed wheat, so that the testa is not so badly broken.

Perfect seed coats are also an absolute protection against short exposures to strong formaldehyde solutions, and are a partial protection against post-treatment injury after disinfection with formaldehyde.

The seed coats of Turkestan barley and of varieties having the same structural type, are broken at the hilum in either machine, or hand thrashing Death results from exposing such seeds to strong copper sulphate solutions for even short periods, or to weaker solutions for a longer time. Barley kernels left attached to pieces of the rachis were not injured by these treatments.

Wheat seeds were always damaged after exposures to saturated solutions of copper-suphate for longer than 7 hours, and sometimes in less time.

The temperature of the solution was found to be a factor in the resistance of wheat to injury from long immersions in saturated copper-sulphate solutions, the germination being poorer as the temperature increased.

864 – **Types of Noé Wheat Resistant to Brown Smut in Italy.** — See No. 810 of this *Review*.

865 – **Flag Smut *(Urocystis Tritici)* a Tilletia Injurious to Wheat, Recently Introduced into the United States.** — TISDALE W. H. and GRIFFITHS M. A., in *United States Department of Agriculture, Farmers' Bulletin* 1213. 6 pp., figs. 2. Washington D. C., May 1921.

Flag smut of wheat (*Urocystis Tritici* Koern), a parasite long known in Australia, where it causes considerable loss every year, and also occurring in Japan, India and South Africa has recently been introduced through some unknown means into the United States.

The first report of the disease in the latter country came from the vicinity of Granite City (Madison Country Ill.) in 1919, in which year a number of fields in the district were found to be infested. During the season of 1920, in the neighbouhrood of Granite City, flag-smut was found in 111 fields comprising 2 500 acres, in an area of about 47 sq. miles.

The disease is characterised by the appearance of black stripes running lengthwise in the leaf blades and sheaths, due to the chlamydospores of the fungus. The upper leaves of the plant are usually the most severely attacked, the stems are also infected to some extent. The diseased plants are generally more or less stunted, and they rarely head out, or produce seed. As a rule, all the stalks of an infected plant are attacked, but occasionally one or two remain immune.

Flag smut is spread in two ways. In thrashing, the spores are knocked out of the diseased leaves and scattered over the grain to which they adhere ; they germinate at the same time as the wheat, when the latter is sown. This is perhaps the chief method by which the pest is propagated, the other way of spreading it, is by means of spores which find their way into the soil from infected straw, stubble and fragments of plants left on the ground when the wheat is cut, and may be carried long distances by wind and running water. Sometimes they are blown out of the separator to land near to the place where grain is being thrashed. In whatever way they reach the field, the chlamydospores germinate there, and if near to seeds, may infect the young wheat seedling in the same way as those clinging to the seeds.

In order to prevent the spread of flag smut beyond the quarantined area in Madison County, and to eradicate it if possible from the infested district, the United States Department of Agriculture and the Illinois Department of Agriculture have taken steps in cooperation, and agreed upon the adoption if the following measures.

1) Thorough treatment of all the grain with formaldehyde as it comes from the separator.

2) Burning all straw in the infected area as soon as possible after thrashing.

3) Sowing no wheat on infected land, and as far as possible sowing no wheat on land which was under wheat the previous year.

4) Obtaining seed from localities known to be free from flag smut.

5) Treatment by the copper-sulphate, or blue-stone method, of all seed to be sown. The coating formed by the blue stone and lime protects the seed from infection by chlamydosphores present in the soil.

6) Growing varieties of wheat that are considered resistant to the disease.

The experiments conducted by the United States Department of Agriculture and the Illinois Agricultural Experiment Station have already shown, that certain varieties of wheat are, more or less, resistant to flag smut.

Fulcaster, Gipsy, Red Wave, Turkey Red, and Early May are wheats with a combination of disease resistance and good yielding ability.* They arethere fore strongly recommended for use in the flag smut area of Madison County.

Certain other varieties (for instance Red Cross, Salzer Prize Taker, Salzer Pride, Dawson Golden Chaff, Illini Chief, and Jones Winter Fife), should not be grown under any consideration in the infested area, because of their susceptibility to the disease.

The United States Department of Agriculture, the Illinois State Department of Agriculture and the Illinois Agricultural Experiment Station are aiding farmers in every possible way to eradicate this destructive wheat pest.

866 - ***Rosellinia* sp., an Ascomycete Injurious to the Roots of the Coffee Plant in Porto Rico.** — MATZ., J., in the *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo, Estación Experimental Insular, Rio Piedras P. R. Circular No.* 32, 11 pp. 2 figs. San Juan, R. R., 1920.

Root disease, although of limited occurrence at present, is the most serious of the maladies attacking the coffee-plantations in the island of Porto Ricco, as it eventually causes the death of infected plants. The most noticeable symptoms are loss of leaves and the withering of the plant.

The usual cause of this root-disease is an ascomycete (*Rosellinia* sp.), which forms characteristic black incrustations in the cortex and wood of the lower part of the stem.

The fungus lives in the soil covered by a thick layer of decomposing vegetable matter consisting, to a large extent, of fallen leaves from the trees planted for the purpose of providing shade for the coffee-plants. If the fungus comes into contact with a single root, it soon spreads over the whole root-system and the base of its host.

Different causes contribute to the development of the disease. One of the principal is irregularity of the ground, which renders cultural operations more difficult in many plantations. Further, the coffee-trees are not planted at proper intervals, so that it is difficult to clear and work the ground around them, while the shade-trees are allowed to grow irregularly, and large quantities of vegetable matter and weeds accumulate on the ground in the plantation, instead of being dug into the soil. The shade trees are not only useful in providing a protection against the intense light of the sun, but also because the leaves falling from them contribute to form a protecting layer, which prevents the necessary moisture from escaping from the soil. In some places, however, not only is the shade too dense, but leaves form too thick and damp a covering on the ground ; in this case, decomposition takes place very slowly, and the decaying mass is an ideal medium for the growth of micro-organisms injurious to the coffee plants. Many of the coffee plants are old, and should be pruned to induce them to send up fresh shoots, or else they should be dug up.

Individuals to be transplanted ought to be selected from the seedlings of vigorous plants.

The most practical method would be to grow coffee-plants and shade-trees alternately in the same row. Enough space ought to be left betwen the rows to allow of spreading manure and hoeing, and of easy access to the trees when the crop is gathered. This system would make it possible to collect the layer of leaves covering the soil into the centre of the space between the rows during the rainy season. The leaves could be again spread over the ground during the dry months. By working the soil, the roots of the coffee plants would be encouraged to grow continually deeper and in this way, they would be less affected by drought. In addition, they would not be so much exposed to the attacks of micro-organisms, since these usually live very near the surface of the soil.

It is not advisable to apply any substances to the soil, the best remedies being good hygienic methods by which the production of the plants is increased, and the disease controlled.

In plantations suffering from root disease, the soil ought to worked and exposed to the action of the air and the sun. Clear soils can be improved in texture by the addition of lime, which renders them more porous, and allows the air to circulate freely in the lower strata.

867 - ***Bacterium exitiosum* n. sp. Injurious to the Tomato in the United States.**

— GARDNER M. W., and KENDRICK J. B., in *Journal of Agricultural Research* No. 2, pp. 123-156, pl. 5. Washington D. C., April 15, 1921.

During recent years, the tomato crops in many of the north Central States (Tennessee, Illinois, Michigan Iowa, Indiana — where the authors researches were made — Georgia, and Florida), have been affected with a spot disease of the fruit of bacterial origin. Outside the United States, this disease has only been found for certain, up to the present, in Canada, and the Union of South Africa.

It attacks both the leaves and fruit of a large number of varieties of tomato. Sometimes, it occurs not only on adult plants, but also on seedlings. From the experiments made, it appears that the fruits of the capsicum, and the leaves of the potato are also infected with this disease.

On the tomato, the fruit lesions are small, black, scab-like spots usually superficial, sometimes crateriform. Leaf lesions are at first translucent, later black and greasy, with transparent margins, and are not usually limited by the veins.

The spots on the fruit are unsightly, and if numerous and large, render the tomatoes unsaleable, further they afford entrance to rot-producing micro-organisms. Canners object to this disease, because even the rather superficial lesions are not removed with the skin, so affected fruits cannot be used for first-grade canning stock.

Seedlings suffer equally severely from this malady.

The pathogenetic organism is a bacterium of which the authors give a detailed morphological and biological account in their paper under the name of *Bacterium exitiosum* n. sp.

Field observations indicate that fruit infection occurs through the punctures of insects. Inoculation tests prove that no infection of fruits takes place unless the epidermis is mechanically punctured. It is not, however. necessary that the bacterium should enter at the time the puncture is made; once present on the surface of the fruit, it takes advantage of any pre-existing wound. Leaf infection apparently occurs through the stomata, and the lesions are more abundant on the lower surface. Young leaves are the most susceptible to the disease.

The bacterium winters on the surface of the seed and is thus disseminated. Commercial seed from fields known to be diseased has yielded about 1 % of infected seedlings. The disease is also propagated by young plants when transplanted.

868 - ***Pseudomonas Apii* n. sp.' a Bacterium Injurious to Celery in the States of New York and Michigan.**— JAGGER I. C., in *Journal of Agricultural Research*, Vol. XXI. No. 3, pp. 185-188, 2 pl. Washington, D. C., May 2, 1921.

Since 1910, a bacterial leaf spot disease of celery has been under observation. It has been widely distributed each season in western and central New York State on all the varieties of celery commonly grown. Of late years, the disease has also made its appearance in Michigan.

It is characterised by spots of a rusty brown colour, irregularly circular in outline, and rarely exceeding 5 mm. in diameter. They closely resemble the leaf blight spots produced by *Septoria Petroselini* var., *Apii*, and can only be distinguished with certainty by the absence of pyconidia, which show as black dots in the *Septoria* spots. Occasionally, the brown spots produced by *Pseudomonas Apii* are so numerous, as to cause the death of many of the older leaves, but usually the injury is limmited to the disfiguring of the foliage, and a possible reduction in the plants growth. As a rule, the leaf blades alone are affected, spots seldom, if ever, occurring on the petioles.

A bacterium, described by the author as a new species, under the name of *Pseudomonas Apii*, has repeatedly been isolated from the infected plant, and the characteristic spots have been obtained by inoculating celery with pure cultures of the micro-organism. When the latter are sprayed on the uninjured leaves, abundant infection is produced through the summer season under field conditions.

During the years 1915-1917, spraying as a means of controlling the disease was tested at Irondequoit and Williamson (New York), Bordeaux mixture (5-5-50) being used, and also commercial lime-sulphur solution (32° Beaumé) which was diluted 1 parts to 25 parts of water. The results obtained seem to show conclusively, that *Ps. Apii* is very satisfactorily controlled by spraying with Bordeaux mixture, but that lime-sulphur solution is useless for this purpose.

869 - ***Thelephora terrestris T. fimbriata* and *T. caryophylea* Basidiomyceles Injurious to Forest-Tree Seedlings in the United States.**— WEIR, R. A., in *Phytopathology* Vol. XI, No. 3, pp 141-144, 1 pl. Lancaster, Pa., March, 1921.

During the years 1912-1916, numerous specimens of three species of *Thelephora* were collected in the several National Forests in the North-West of the United States. Of these, one *T. terrestris*, Ehrh., was already known in Europe as attacking the seedlings of various forest trees, while the other two *T. fimbriata* Schw. and *T. caryophyllea* (Scheffer) Fr., were reported for the first time as injurious in this respect. The destruction caused by these basidiomycetes is due to the fact that they rapidly invest the organs of the plant (especially the stem, but also the leaves and root) either wholly or partially, so that the seedling is finally strangled.

T. terrestris has been observed to injure forest-tree seedlings in the States of Washington (on *Pseudotsuga taxifolia*, *Pinus monticola*, and *Thuja plicata*); Oregon (on *P. ponderosa*) ; Idaho (on *Abies grandis*, *Ps. taxifolia*, *P. ponderosa* and *Picea Engelmanni*) ; Montana (on *Larix occidentalis* and *P. contorta*); Utah (on *P. ponderosa*); Wyoming (on *P. contorta*) ; South Dakota (on *Acer Negundo*) ; Minnesota (on *P. mariana* ; Michigan (on *P. divaricata*) ; and Indiana (on *Quercus alba*).

The same fungus has also been found in British Columbia (Canada) on *Acer macrophyllum* and *Ps. taxifolia*.

It behaves in the same manner to various plants other than the seedlings of forest trees.

T. terrestris frequently appears in the sandy soil of forest-tree nurseries, and especially where the plants are dense enough to shade the ground. Although the behaviour of the fungus is often apparently parasitic, repeated examination of the young pine-seedlings enveloped by it has not shown any living part to be invaded. The mycelium ramifies in the surface soil, and merely penetrates the dead outer tissues of any plant encountered. If the plant is completely smothered by the fungus, the mycelium may penetrate into the tissues of the leaves through the stomata, and even form a brown layer between the dead bark and the wood of the stem. The fungus is often found hibernating in the thick moist bark at the base of young trees, and in this case, the mycelia may not be connected with the forest soil, but may draw its nourishment entirely from a damp, woody substratum. It has been found that the substratum exercises an influence on the form and colour of the basidiomycete.

During damp weather, the fungus grows very rapidly and may envelop a small seedling in a comparatively short time. It grows most rapidly during the night.

Nursery seedlings that are affected with *Thelephora terrestris* should be pulled up and burnt. It was found that where this was done the fungus did not develop in the beds the following year. The use of forest soil in the seed beds promotes the growth of the basidiomycete.

In 1914, and again in 1915 *T. fimbriata* appeared in considerable quantity at Haugan (Montana). Two-and three-year-old seedlings of *P. ponderosa* were in some cases completely enveloped. The same fungus was found, in 1916, on seedlings of *P. rigida* in Lycoming County (Pensylvania).

T. caryophyllea was observed on one-year-old seedlings of *Larix occidentalis* and *Tsuga heterophylla* in the seed-beds at the Priest River Experiment Station (Idaho).

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Since then it has not reappeared, but is abundant in the surrounding forest, where it is occasionally found enveloping the stem of young lodgepole-pine seedlings.

INJURIOUS INSECTS AND OTHER LOWER AMIMALS

870 – **Lepidoptera in Texas Likely to be Confused with the Pink Bollworm of Cotton. — *(Pectinophora gossypiella)*** (1). HEINRICH, C., in the *Journal of Agricultural Research*, Vol XX, No. 11, pp. 807-836, pl. 18. Washington, D C, March 10, 1921.

The author purposed in this paper to define the characters distinguishing the larva and pupa of the pink bollworm, *Pectinophora* (*Gelechia*) *gossypiella* Saunders from those of other Lepidoptera attacking cotton, or related malvaceous plants, and of those feeding on other quite different hosts, but frequently found in the neighbourhood of cotton fields.

A few of these Lepidoptera, *Dicymolomia iulianalis* Walker, and *Crocidosema plebeiana* Zeller, for example, so closely resemble the pink bollworm in their habits and larval stages, that they can only be distinguished by a careful examination of their structure.

The field work upon which this paper is based was conducted throughout the area in south eastern Texas where the pink bollworm has been found to occur, as well as in Cameron County at the southern extremity of the State. Special attention was devoted to discovering whether *Pect. gossypiella* was attacking plants other than cotton. Thousands of seed pods of okra (*Hibiscus esculentius*) and other Malvaceae were examined. In one case, at Smith's Point (Chambers County), all the seed pods of a plant related to cotton (*Hibiscus lasiocarpus*), growing in the immediate vicinity of a field where a heavy infestation of the pink bolloworm had occurred during a previous year were removed and minutely examined. Similar investigations were made on other wild and cultivated Malvaceae growing in, or about fields where the pink bollworm had been found. In no place was the bollworm discovered on any plant other than cotton.

In this paper, 38 species of Lepidoptera, in addition to *Pect gossypiella* are described. Of these, six are mentioned as new to science and four already described are recorded for the first time from the United States.

In each case, the male genitalia of the type specimen of the new species is figured. The essential larval and pupal characters are dealt with in the text as fully as possible, and purely descriptive matter is reduced to a minimum.

The species are as follows: —

1) Fam. *Gelechiidae: Pectinophora gossypiella* (Saunders); *Gelechia hibiscella* Busck; *G. bosquella* (Chambers); *G. neotrophella* n. sp. *Telphusa mariona* n. sp., *Isophrictis similiella* (Chambers).

2) Fam. *Oecophoridae: Borkhausenia diveni* n. sp.

3) Fam. *Stenomidae: Aedemoses haesitans*. Walsingham.

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(1) See *R*, Sept. 1917, No. 879. (*Ed*)

4) Fam. *Blastobasidae: Zenodochium citricolella* (Chambers); *Holcockera ochrocephala* Dirtz: *H. confamulella* n. sp.

5) Fam. *Ethmiidae: Ethmia delliella* (Fernald); *Eth. bittenella* (Busck).

6) Fam. *Cosmopterygidae* : *Pyroderces rileyi* (Walsingham).

7) Fam. *Tortricidae: Platynota rostrana* (Walker); *Pl. flaveiana* Clemens; *Amorbia emigratella* Busck.

8) Fam. *Olethreutidae: Crocidosema plebeiana* Zeller; *Eucosma discretivana* n. sp., *Euc. helianthana*, (Riley); *Laspeyresia tristrigana* (Clemes).

9) Fam. *Phaloniidae: Phalonia cephalanthana* n. sp.

10) Fam. *Aegeriidae: Zenodoxus palmii* (Neumoegen).

11) Fam. *Pterophoridae: Oedematophorus venapunctus* Barnes and Lindsey.

12) Fam. *Pyralidae*: *a*) sub-fam. *Thyridinae* : *Meskea dyspteraria* Grote; *b*) sub-fam. *Pyraustinae: Noctuella rufofascialis* (Stephens); *Pachyzancla bipunctalis* (Fabricius); *Glyphodes pyloalis* Walker; *c*) sub-fam. *Crambinae; Dicymolomia julianalis* (Walker); *d*) sub-fam. *Phycitinae: Moodna ostrinella* (Clemens); *Homoeosoma electellum* (Hulst); *e*) sub-fam. *Chrysauginae: Clydonopteron tecomae* (Ruley).

13) Fam. *Noctuidae*: (*a*) sub-fam. *Agrotinae: Heliothis* (*Chloridea*) *obsoleta* (Fabricius); *Hil.* (*Chlor.*) *virescens* (Fabricius); (*b*) sub-fam. *Acronyctinae: Bagisara rectifascia* (Grote); *c*) sub-fam. *Erebinae: Alabama argillacea* (Hübner); *Anomis exacta* Hubner; *An. erosa* (Hübner).

14) Fam. *Lycaenidae: Strymon melinus* (Hübner.

871 – **"*Muscardine*" *(Botrytis Bassiana)* Disease attacking Silkworms and other Insects.** — See No. 844 of this Review.

872 – **The Use of Rubber Tents in the Fumigation of Trees with Hydrocyanic-Acid Gas.** — *The India Rubber World* Vol. LXIV, No. 2, pp. 555-556, figs. 3. New York, May, 1921.

For twenty years, the growers of citrus fruits have sought in various ways to check one of the greatest drawbacks connected with the use of tents in the fumigation of trees with hydrocyanic acid, viz. gas leakage through the cotton fabric of which the tents were made; but even the application of a mucilage made from boiled *Opuntia* leaves mixed with linseed oil failed to made the material impermeable to the confined fumes.

After much study, G. HOCKENSMITH, an American expert on balloon fabrics, has succeeded in solving the problem. Having chosen a suitable material, he subjected it to the treatment given to balloons, and dirigibles during the War, the fabric not only being rubberised and made perfectly gas-tight, but also given an aluminium-colour facing, that makes the tent also opaque. The advantage of opacity is, that fumigation may be carried on in the tents, three or four hours before sundown. Experience with the plain canvas tents has proved, that day fumigation gives decidedly inferior results to night work. For some reason not yet explained, sunlight on ordinary tents during the fumigation of trees with liquified hydrocyanic gas often causes peculiar injuries to the fruit and leaves. Hence, the practice of doing most of the fumigation after sunset. It is claimed, that the new rubberised cloth tent will effectually keep out the actinic rays of the sun which are believed to be the rays exerting an injurious effect in conjunction with the gas, thus making daylight fumigation possible.

The new rubber tents are octagonal in shape, the centre being made of the heavy material, and the wings or sides, of a coated fabric which is somewhat lighter. Such construction not only reduces the weight of the tent, but also makes it easier to handle in the field. As might be expected, the cost of the rubberised tents is higher than that of the ordinary type but the advantages more than compensate for the extra cost.

A severe test, not only of the efficiency of the new tents in retaining, gas but also of their durability, was carried out recently at Corona, (California) where they were used for fumigating a thousand lemon trees.

Standardisation of fumigation has hitherto been impossible with such a variable factor as gas-leakage, which may always occur with porous sail-cloth, and is often influenced by weather conditions. To hold a definite amount of gas for a definite time is the very basis of fumigation, and these two essentials can be obtained by the use of gas-tight tenting material; with the latter, exact dosage can now be attained, not only to insure results, but also to avoid any danger to the tree from injury by excess gas, or over exposure. Further, by adopting the new type of tent the dosage for small trees can be reduced by two-thirds, for average-sized trees one half; and for very large trees one quarter. Also the time-exposure may be shortened from about an hour to an average of thirty minutes.

During fumigation, trees must be kept dry. Ordinary canvas tents often allow damp to reach the fruit and foliage; and when the liquified hydrocyanic acid unites with the moisture, serious damage may be done to the tree. Under a rubber tent, the tree may be entirely protected from both damp and wind, which latter also interferes to some extent with the fumigation process.

Even in the time taken for covering a tree, the use of the new tents effects a 50 % saving.

873 - *Tipula simplex* and *T. quaylii* Diptera Injuring Pastures and Grain and Lucerne Fields in California.

— PACKARD C M, and THOMPSON B G, in *United States Department of Agriculture, Department Circular* No 172, 8 pp figs 5. Washington, D. C, May 1921.

Californian pastures, and also the grain and lucerne fields, are often badly injured during the rainy season by the larvae of crane-flies, *Tipula simplex* Doane and *T. quaylii* Doane; which are frequently exceedingly abundant; in certain spots, as many as 300 to the square foot are found They devour all the grain and vegetation in these areas. The injury done by these insects is usually more noticeable during wet winters, such as that of 1920-21, but they occur in large numbers almost every winter in some locality, and a few can as a rule be found every year throughout the area inhabitated by this pest. On large stretches of pasture land, the larvae often destroy in a single year thousands of dollars worth of forage, for lack of which the live stock sometimes die of starvation. Further, they are likely to attack all winterplanted field crops, especially on newly-broken sod land, where the flies have an opportunity to breed and multiply undisturbed through several successive seasons.

The authors describe the habits and the different stages of *T. simplex* which are very similar to those of *T. quaylii*.

So far, the only known method of reducing the damage caused by these two diptera has been more or less continual cultivation This, however, is of no avail to save a crop that has already been planted, and is being destroyed by crane-flies. Cultivation can only prevent possible injury in future years, and cannot be applied at all to large areas of pasture land.

It had however been observed, that the larvae come out at night upon the surface of the ground. This fact, together with the indication that the species in question feeds upon the aerial portions of plants more than is commonly supposed, suggested the possibility that they would be attracted by the poisoned-bran bait commonly used for grasshoppers. During the winter of 1920-21, experiments were made in badly infested areas to determine the efficiency of poisoned bran in destroying the insects.

As a result, from 50 to 90 per cent of the larvae were killed on the experimental plots where several different poisoned-bran formulae were tried. The mixture usually recommended for the control of grasshoppers, which contains molasses and lemons added to the bran, Paris green and water, killed an average of 72 per cent of the crane-fly larvae present. Fully as high a percentage of mortality was however obtained on the plots where a mixture of bran, Paris green and water without any flavourings was used, and as this is cheaper and easier to make, the authors recommend a bait made in the following proportions: bran 25 lb. Paris green 1 lb. water (to make a flaky mash) about 3 gallons. The Paris green is mixed thorougly into the dry bran, then the water is gradually added, till an even, crumbly mash is obtained. The mixture can be spread broadcast by hand, or if the area is of considerable size, it can be scattered very easily and rapidly with a horse-drawn grain-seeder. Ten to twenty pounds per acre was the smallest amount that gave a uniformly high percentage of mortality over the entire plot. When less was used, the number of dead insects varied greatly on different parts of the plot, because of the difficulty of making an even distribution of the bait.

Amounts larger than 20 pounds per acre did not increase the efficacy of the bait, though when this is spread evenly and smoothly with a grain-seeder, good results can probably be attained with smaller quantities than if more or less unevenly sown by hand. The poison should be scattered broadcast over the entire infested areas, rather than in strips, because the larva of the crane-fly does not ordinarily travel far in search of food. The cost of this poison, made as recommended above is not great, and it is an efficacious practical remedy, that can easily be applied to crops attacked by the larvae of either *Tipula simplex* or *T. quaylii*. Precautions must be taken not to allow the poisoned bait to fall into lumps when spreading it on the field, and to avoid leaving quantities of it in places to which children and animals have access.

This bait has, however, been spread many times where cattle and sheep have been grazing, with absolutely no injury to the stock.

874 - ***Prodenia litura*, a Macrolepidopteron Injurious to Rice in Goa Portuguese India** (1). — CORRÊIA, ALFONSO, P. P., in the *Governo Geral do Estato da India, Direcção dos Servicos Agricolas e Florestais, Boletim de Agricultura*, Year II, Nos. 1-4, pp. 16-19. Nova Goa, 1920

The rice-fields of some villages of Salcete have recently been attacked by various species of migratory larvae, amongst which — according to the results obtained by artificial rearing — the most numerous were those of the two macrolepidoptera, *Spodoptera mauritia* and *Prodemia litura*.

Three methods of controlling the latter insect were traied (its habits are similar to those of the former):—

1) The use of poisoned baits containing arsenic; 2) catching the caterpillars in a special net swept over the plants attacked, the insects being afterwards killed or buried; 3) covering the surface of the water in the rice-fields with a petroleum emulsion, after passing a bamboo horizontally over the tips of the plants, and thus detaching, the caterpillars, which fell into the water. The third method was the most successful.

There are, however, other ways of combating the pests. On ascertaining the direction in which the caterpillars are proceeding, they can be prevented from reaching the nearest rice-field by cutting all the grass for a space 5 to 8 metres, thus forming a wide isolating band. Thus cut off and deprived of the plants necessary for their sustenance, the caterpillars die before arriving at the opposite margin of the strip that has been mown. The same results can be obtained by digging a sufficiently deep trench running across the caterpillars' path. Spraying with lead arsenate is also advisable, but it should be done at a time when there is no fear of its being washed off by the rain.

If none of these control measures are adopted, the ground should be ploughed deeply, in order to expose the chrysalids to their natural enemies, and to the destructive action of the sun's rays. By taking this precaution, the probability of a near fresh invasion of the insect is considerably diminished.

875 - ***Mineola indiginella* a Microlepidopteron Attaching *Cotoneaster* spp. in New Jersey.** — WEISS H. B. in *The Canadian Entomologist*, Vol. LIII, No. 4, pp. 73-75. Guelph, April, 1921.

For some years past, *Mineola indiginella* Zell. a microlepidopteron normally feeding on apple, quince, plum, cherry, peach and pear, which is rarely troublesome in well-kept orchards, — has been observed attacking various species of *Cotoneaster* especially *C. microphyllla* and *C. horizontalis*, in a nursery at Rutherford (New Jersey).

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(1) See also *R.* Oct. 1912, No. 1476; *R.* Nov. 1912, No. 1585; *R.* Feb. 1913, No. 193; *R.* May 1914, No. 479; *R.* July, 1914, No. 690; *R.* May 1916, No. 590. (*Ed.*)

The habits of the insect on *Cotoneaster* are practically identical with those noted on apple-trees.

In the spring, the caterpillars open the large ends of the tube-like cases in which they hibernate (these are fastened securely to a twig for their entire length), and web up the foliage in the vicinity of these cases; later they feed on the leaves, flower-buds etc. Many of them feed on the green bark at the mouths of the cases, and sometimes strip it off all round the twig. As the larva grows, it enlarges its case. The larva becomes full grown about the first, or second week of June it then loosely closes the opening of its tube with particles of leaves and silk, and transforms into a pupa. After about two weeks, the moth appears. There is only one brood annually, and the July eggs produce over-wintering larvae. Most of the caterpillars appear to feed at night; they remain in their tubes during the daytime.

Considerable damage can be done to *Cotoneaster* by this insect, which is popularly known as the apple leaf-crumpler; when several larvae are present on one twig, it is soon girdled, moreover the leaves are small and the branches soon stripped.

The author gives a detailed morphological description of the larva of *M. indiginella*. At Rutherford they are parasitised to some extent by *Tachina phvcitae* Le Baron. Arsenic sprays applied early in the season of infested apple-trees, should prove effective.

876 - ***Ctenophora atrata*** **a Dipteron Attacking the Birch in Switzerland.**— BARBEY, A., in the *Bulletin de la Société vaudoise des Sciences naturelles*, Vol LIII, (1920), No. 199, pp 259-262, 1 pl Lausanne, June 19, 1921.

Ctenophora atrata L. was found in September 1915, in the Vallée de Conches (Canton of Valais), on the road leading to the village of Grengiol, at the entrance of the Binnthal (altitude 1200 m.). Holes 4 to 5 m.m. in diameter were discovered on birch-trees of which the wood was partly decayed, though in some cases it was still covered with bark. In the interior of the galleries, together with the larvae of certain polyphagous coleoptera, there were other very characteristic caterpillars, which when reared in the laboratory, proved to be the larvae of *Cten atrata.*

This wood-borer had already been repeatedly found in Switzerland and in Italy (Piedmont); it would also appear to be by no means rare in Belgium where its larvae also attack the birch.

Cten. atrata does not confine itself however to the birch, but also infests the poplar, alder, and lime; it is therefore a polyphagous insect, but probably eschews trees with resinous wood. On account of its large size, and preference for damp ligneous matter, the larva travels but short distances, and does not always leave behind it galleries of a very defined type. An examination of the injuries produced show that the insect excavates its burrows without any particular system. The galleries may be of different diameter, and the passage of the dipteron, as shown by its excreta, can be traced from the phloem to the heart of the decayed or dead branches and trunks. In dry wood which offers a certain resistance, the galleries made by the larvae are long and fairly regular, but this is the exception.

Pupation takes place in July, and lasts from two to three weeks, the process is carried out in an elongated, but irregular cavity situated near the periphery of the trunk.

877 - ***Stilpnotia salicis* a Macrolepidopteron Injurious to Poplars and Willows, Reported for the First Time from Massachusetts and New Hampshire** (1). — BURGESS, A. F., in *United States Department of Agriculture, Department circular*, 167, 16 pp. 7 figs. Washington D. C., May 1921.

The satin moth (*Stilpnotia salicis* L.) — an insect well known in Europe for the injury caused by its larvae to poplars and willows — was reported for the first time in the United States about July 1, 1920. At this date, it was found, that a number of poplar trees (*Populus monilifera* var. *angulata*) on the Malden and Medford line north of Boston (Massachusets) were being defoliated by the larvae of this insect. A hasty examination showed, that the most severe defoliation was in the region where the caterpillars were first reported, and several trees in a small group of *P. pyramidalis*(Lombardy poplar) had been completely stripped.

Observations in the field, in 1920, indicated that the small larvae of *St. salicis* chiefly fed on different species of poplar, those most severely attacked being the Carolina (*P. monilifera* var. *angulata*), Lombardy (*P. pyramidalis*), Balm of Gilead (*P. balsamifera*) and Silver Leaf (*P. alba*).

As regards the distribution of the satin moth in the United States, the insect is now known to occur over an area of 642 square miles, including 60 towns in Massachusetts, and 4 in New Hampshire. Probably a few of the insects had already existed for some years in the locality where they were first observed.

While it is impossible to determine the original source of the infestation it is very probable that *St. salicis* was brought into the United States during the dormant season in crevices of the bark of live or dead trees; bits of infected bark mixed with packing material could easily furnish a means of transporting the insect, for the hibernating webs of the small larvae concealed in the crevices of bark are so inconspicuous as to escape even careful inspection.

The larvae and pupae of the satin moth are effectively attacked by the adult and larval forms of *Calosoma sycophanta*. Another formidable enemy of the larger larvae of *St. salicis* is *Compsilura concinnata* Meigen.

Telenomus californicus Ash. is a parasite that has been reared from the eggs of the satin moth. The prospect of controlling the latter by parasites is encouraging but it may be necessary to import into the United States from Europe some of its enemies that do not at present exist in the former country.

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(1) See also *R.* May 1921, No 595. (*Ed*)

Time has not permitted experiments to be carried out in the infected area to determine the most effective remedies against *St. salicis*, but from what is so far known concerning the latter — the paper analysed gives the data collected during the summer of 1920 respecting the stages of development and the habits of the insect — the following treatment would seem advisible.

1) Spray poplars and willows as soon as they are in full leaf with arsenate of lead at the rate of 10 lb. to 100 gallons of water, using soft soap to make the remedy adhere to the leaves.

2) If the infestation is severe, it may be necessary to repeat the operation by the middle of June.

3) If egg clusters are abundant on the trees in July, spray again with the same material about August 1.

The experience of a full years work on this insect will proably results in a modification of these recommendations.

INJURIOUS VERTEBRATES

878 - ***Epimys rufescens* and *Nesokia bengalensis* (?), Rodents Attacking the Coconut Palm and Cereals Respectively at Goa, Portuguese India.** — *Govèrno Geral do Estado da India, Direcção dos Serviços Agricolas, e Florestais, Boletim de Agricultura* Year II, Nos. 1-4, pp. 19-22, figs. 3. Nova Goa, 1920.

Epimys rufescens is undoubtedly one of the most dangerous enemies of the coconut, and the fruits, that this rodent destroys may be counted by thousands. It lives in a nest built at the top of the tree. It is capable of breeding when less than a year old, and always produces 5 to 10 young in a litter. There are at least 5 litters a year.

The little pest makes a round hole in the soft part of the green nut, sucks out the milk, and devours the recently formed kernel. Thus damaged, the fruit soon falls from the trees.

The rodent has some natural enemies among birds, reptiles and mammals, but many of these are destroyed by man owing to ill-founded suspicions, and also superstition connected with some of them (birds and reptiles).

Traps and poison are of very little use against *Epimys rufescens.*

In large plantations, in districts where the ground is covered with heath, each tree cannot be treated separately, owing to the great expense this would entail; therefore recourse is had to large fires. Piles of combustible material are placed in the plantation on the side whence the wind blows, and lighted towards evening, when the breeze gets up. Substances with a pungent, penetrating smell (sulphur, incense etc),as well as a little ground pepper, are strewn on the burning heap. The smoke spreads through the plantation, rising to the tops of the palms and drives away the rodents, which never again return. Men and animals must avoid the centres where these fires are kindled.

The preventive control measure which has hitherto proved most efficacious is to surround the trunk of the coco-palm completely at the height of 2 m. or more, from the ground, with funnels made of tin or zinc, and placed mouth downwards. These funnels should be 30 (or better) 15 cm. wide, and previously covered with tar.

Palms provided with these funnels must not be in contact with other unprotected trees, or with the branches of trees, which must be cut back systematically to within a distance of 2 m. from the palm Before surrounding the trunks with the above-mentioned protective apparatus, the tops of the palms should be carefully examined, and any nests found at once destroyed.

The severity of the invasion can be much reduced by leaving sufficient space between the trees, the proper aeration of their summits, and the general cleanliness of the plantation.

Another rodent, which is probably to be identified with *Nesokia bengalensis,* comes out of its nest in the ground at night and destroys cereals either by cutting off the tender plants or by gnawing the ears

The best way of killing these animals in their nests it by means of an apparatus sold under the name of the " White Ant Exterminator. " Naphthaline placed at the entrance of the nests drives the rodents away.

A mixture of 15 gm. arsenic and about 900 gm. of wheat flour should be strewn over the infested fields at night.

[878]

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BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART

Description of valuable Chinese books presented to the Library of the International Institute of Agriculture

By GUIDO PERRIS.

The President of the Chinese Republic has been pleased to offer to the Library of the International Institute of Agriculture a work no less rich than rare — the splendid album descriptive of agriculture and silk-culture in China which was published in sumptuous style by the Emperor K'ANG HSI (1662-1722).

At the same time his Excellency LU-CHÊNG-HSIANG, formerly Minister of Foreign Affairs, who visited the Institute in 1919, expressed the desire to supplement on his own account the magnificent present of his Excellency the President of the Chinese Republic by the gift of a number of classical works on the subject of agriculture, also published in a most artistic form.

In order to testify to their gratitude to their Excellencies, the President of the Chinese Republic and LU-CHÊNG-HSIANG, the Permanent Committee of the Institute of Agriculture decided at one of its recent meetings to direct special attention in the Monthly Bulletin to the importance of this precious gift.

The brief review which follows will, it is hoped, serve to give an adequate idea of the high historic, artistic and scientific value of the works with which the Library of the Institute has recently been enriched.

The *K'ang hsi yü chih kêng ch'ih t'u* (1) or pictures of agriculture and silk-worm breeding published by the Imperial Court of K'ANG HSI may be regarded as a graphic representation of the forms in which agriculture and silk-culture were practiced in China during the reign of the Emperor K'ANG HSI (1662-1723).

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(1) For purposes of the transcription of Chinese words into Latin characters, the orthography of Sir Thomas WADE, adopted by GILES in his *Chinese-English Dictionary* has been followed. Consonants and groups of consonants are always sounded as in English while vowels are pronounced as in Italian. A reversed apostrophe (') signifies that the consonant to which it is prefixed should be aspirated.

The somewhat curious history of this work dates back to the XIIth Century. In 1145 LOU SHOU, Governor of Yu ch'ien, presented the Emperor KAO TSUNG (1127-1162), the first representative of the Southern Sung dynasty, with a collection of drawings and poems entitled "*Kêng chih t'u shih*", i. e. Poems and pictures of agriculture and weaving." The drawings were intended to represent the methods of field work as practised at the time and the songs to express the sentiments of the country people. The present greatly pleased the Emperor and the work was engraved on stone in 1210 under the direction of a nephew of the author and remained popular for a long time. But though the songs have come down to us, the pictures have been almost entirely lost and it was only recently that a reprint of the book was discovered in Japan. The reprint was made in the XVIIth century and contains reproductions of the original illustrations.

The Library of the Institute already posesses a copy of the *Kêng chih t'u shih*, " Poems and pictures of agriculture and weaving, " by LOU SHOU, which appears in a volume included in a collection of rare works belonging to different dates and of a different character. This was published by the Emperor CH'IEN LUNG (1736-1795) with the title of: *Chih pu tsu chai ts'ung shu* and bears the date of 1781 (1), and includes two others works on agriculture, both important and rare. Of these the first is the *Nung shu* (handbook of agriculture) of CHÊN FU, a small treatise published for the first time in 1149. This work is divided into three chapters (*chüan*), the first of which deals with agriculture proper and includes twelve numbered sections followed by two that are not numbered; the second deals with cattle breeding, contains a preface and two numbered sections; the subject of the third is the rearing of the silkworm and the culture of the mulberry, with a preface and five numbered sections. There is also an author's preface followed by notes which provide interesting information on the importance and the history of the *Nung shu*. This is followed by a short disquisition on silk-growing, the *Ts'an shu*, written by the celebrated littérateur, CH'IN KUAN (1049-1101), which was probably printed for the first time in 1214. It consists of nine brief sections, each containing short instructions on the rearing of silkworms, and of three interesting notes on the objects and origins of the industry.

Two important notes by WAN TSO-LIN, a writer of the CH'IEN LUNG period come next and are followed by a reproduction of LOU SHOU's *Kêng chih t'u shih*. Only the text, however, is given, consisting of 21 poems on agriculture and 24 on weaving. Immediately after the poems and on the back of the 8th and the front and back of the 9th folios appear the observations of Lou Hung, the nephew of the author, bearing the date of 1210, which are of great importance for the history of Lou Shou's work. This is followed by an appendix entitled *Kêng chi t'u hou hsü* with observations by another nephew of the author, called Lou Yo (1137-1213), who held high office in the Empire and was a writer of repute. The whole concludes with some brief remarks by Lou Shao grand nephew of Lou Shou, dated in the first year of the reign of Chia Hsi, about 1237.

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(1) This book contains a final note which makes it possible to establish its date. The note states that on the 19th day *jên ch'ên* of the first month of the year *hsin ch'ou* (1781) of CH'IEN LUNG, a certain FANG P'U of Jên Ho finished his task of transcribing the 18705 monosyllables which make up the volume.

These various comments, which provide interesting details with regard to the origin and vicissitudes of Lou Shou's work, at the same time testify to the interest and enthusiasm aroused, even in the days of the Sung Dynasty, by the publication of Lou Shou's collection of pictures and poems about agriculture and weaving. The work is in brief a glorification of agriculture, inspired by the respect and veneration with which it has always been regarded by the Chinese Nation.

Wan Tso-lin's remarks (the first dated 1738), to which reference has been already made, acquaint us with the fact that the three former works were offered by certain literati in the Chiangnan (1) to the Emperor K'ang Hsi who was travelling at the time in the Southern Provinces. The copies offered to the Emperor were based on all the rarest editions of the Sung epoch.

The *Kêng chih t'u shih* of Lou Shou at once interested the Emperor very deeply, so much so that he desired to have a second edition made and illustrated by drawings more in accord with the contemporary spirit. He entrusted the celebrated artist Chiao Ping-chêng with the carrying out of the drawings, and himself wrote for each picture a poem descriptive of the subject.

The work was published in 1696 in an elaborate form with a preface by the Emperor, emphasizing its importance and scope. Below is given a translation to indicate the lofty political interest with which the Emperor was inspired in the deep veneration which he cherished towards agriculture, which in fact during the whole period of his reign received every possible encouragement.

Preface by the Emperor K'ang Hsi.

" Morning and night my thoughts turn to the state of the Empire and my heart is full of anxiety for the future. When I consider the foundations on which rest the life of my people, food and clothing appear to be the most important of all. Moreover I have read the Chapters " On the Customs of *Pin* " (2) and " The Precepts against Extravagance. "

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(1) The actual provinces of Chiang-su and Anhui.

(2) The chapter " On the customs of *Pin* " (*Ping fêng*) is the fifteenth book of the first part (*kuo fêng*) of the *Shih-ching* "Book of Odes", one of the sacred books of China, and consists of a very valuable collection of odes and popular songs, recited and sung on different occasions, and dating back to different periods between 1769 and 600 B. C They were

The recommendations therein contained on the subject of seed time and harvest, the rearing of the silkworm and the cultivation of the mulberry are full of interest and at the same time complete. At all periods in the past, these subjects have been handled to the sound of the flute and the accompaniment of the harmonies of stringed instruments as well as discussed in laws and edicts. It is the duty of whosoever presides over the well-being of the Empire to reflect continually on these questions.

The laws of the Western Han Dynasty (1) which so nearly approach antiquity say " Injury to agriculture gives birth to famine, confusion in women's weaving work causes suffering on account of the cold. " They say again that " Old men shall die after a long life and young people shall reach an advanced age. "

If a man attempts to realize these precepts while neglecting the fundamental laws on which they depend, all his labour with be nothing worth.

Every time that I have travelled about the provinces and have heard the sound of the voices of the country people, I have been rejoiced to note the signs of agricultural labour, the condition of the land in the North and in the South, the preparations for the sowing of millet and rice, the

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selected and classified by Confucius himself. *Pin* is the name of the capital of a small feudatory state belonging to the family of the Chou before it took possession of the throne. This chapter on the customs of *Pin* deals with the subjects of agriculture and weaving in a style that has become classic, an object of admiration and a model for all Chinese literati and poets, who seek its inspiration every time they compose poems dealing with agricultural work.

This ode, which depicts with a sentiment profoundly religious, the conditions of life among the people of *Pin*, their field work varying in accordance with each month of the year, the prosperity which the inhabitants enjoyed as a result of the beneficent institutions of a wise Government, is always referred to with sorrow and regret, as the far-away picture of the type of prosperity that a tiny state had been able to obtain, thanks to the wisdom and piety of its rulers many centuries before our era.

In thus alluding to it, K'ang Hsi makes evident his intense interest in agriculture and the well being of his people.

" The Precepts against Extravagance " (*Wu i*) are found in the 15th Chapter of the *Chou shu*, " historical records of the Chou dynasty, " which is itself the fifth part of the " *Shu ching* " or Book of History, another book regarded as sacred by the Chinese nation, which covers a period dating from the middle of the XXIVth century B. C. to the year A. D. 721. Agricultural work is praised in this chapter also, and the Emperor's reference to it has the same motive as that to the chapter " On the customs of *Pin*. " Both chapters are ascribed to the Duke of Chou (Chou Kung, d. B. C. 1106) brother of the first Emperor of the CHOU dynasty and renowned throughout the ages for his wisdom and virtue.

(1) The Western or Former Han Dynasty was in power from B. C. 206 to A. D. 23. It is therefore considered by the Chinese as very closely approaching the period of classical antiquity which is taken as a model of good government and morals, and embraces a period, which starts with the beginning of Chinese history and lasts till the fall of the Chou dynasty in the 3rd Century B. C. The precepts quoted by the Emperor K'ang Hsi are to be found in an edict of the Emperor Ching Ti (B. C. 156-140) published in B. C. 145 to call upon the people and magistrates to devote the utmost attention to agriculture in order to avoid the risk of famine. This edict which is reproduced in the History of the Western Han Dynasty is likewise quoted in the *Shou shih t'ung k'ao*, book 43, fol. 1, back.

variety of the seasons and the measures taken to destroy the locust. It has been for me a true pleasure to seek and obtain exact information on all such matters.

When busy with affairs of state, I discuss the problems with Ministers and Officials on the borders of the " Well-watered Garden " (1), wherein are many cultivated plots while the peasants allow the water of the stream to run freely in the furrows, and the eye rests upon a succession of rice fields, and the ear is filled with the clatter of buckets. The peasants can safely reckon on the ripening of an abundant crop consisting of many thousands of *chung* (2). Mulberry trees are planted on the borders and all along the footpaths and close to them huts have been built for the rearing of the silkworm. The cocoons are washed and the silk is wound and so the work proceeds exactly as though under the thatched roof of peasant's cottage. Moreover I have built the Pavilion called " The Knowledge of Agriculture " and the " Kiosk of the Autumn Cloud " in order to be able to observe all the processes in detail.

It was a saying among our ancients : " Let him who is clothed in silk think of the cold from which the weaver woman has suffered : let him who eats the loaf remember the weary labours of the peasant. " On these maxims my thoughts dwell deep and long. For this reason I have ordered the " Pictures of agriculture and weaving " to be designed, each subject being illustrated by 23 drawings.

To each of these pictures I have added a poem of my own composition, and these I have written so that they may be used as songs to beguile the labour and the weariness of the field.

The pictures represent the weary toil of the peasant, which raises hard places on his feet and hands, and the harsh life of the women who rear the silkworms and have the care of the cocoons, the silk and the weaving. The field work is depicted in most complete and minute detail from beginning to end.

I have ordered new plates to be engraved in order that these pictures may be handed down to posterity and that our sons and grandsons, and our subjects of all classes may learn that the wheat, which is their staff of life, is cultivated with toil and pain, and that the raiment they wear is no less difficult to provide.

In the *Shu-ching* (Book of History) is written this precept: " But love the good gifts of the soil, and you will be pure in heart. "

Of a truth these pictures contain much to stir the heart. But my chief desire is that they may serve throughout my Empire, to give each a pride in his own work, in order that he may be able to devote himself to it with all his strength and live sparingly, so that the fruits of the earth may ever more and more increase.

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(1) " The Well-watered Garden " (*Fêng tsê yuan*) was in the grounds of the Imperial Palace at Pekin. It was laid out by the Emperor K'ANG HSI and contained several *mou* of rice-fields, many rows of mulberry trees and many nurseries of silkworms. In the *Shou shih t'ung k'ao*, book 51 fol. i (front and back) and fol ii (front) a description of this garden is given in the form of a poetical essay by the Emperor CH'IEN LUNG, entitled *Fêng tsê yuan chi.*

(2) An ancient Chinese measure of capacity, equivalent to 6 *hu* and 4 *tou.*

When there is enough and to spare of food and clothing, each citizen will be able to reach the realm of peace and concord, prosperity and long life. Such is my heartfelt prayer in my profound desire for the well-being of the mass of my people.

Composed and written by the Imperial hand in the 35th year of K'ANG HSI (1696) in the second month of spring, on the 5th day dedicated to the Divinity of the Earth (1) ».

The work which has been presented to the Institute by His Excellency, the President of the Chinese Republic, is of exceptional rarity (2) and a perfect treasure-house of Chinese typographic art. CHIAO PING-CHÊNG's plates are dry point engravings on wood and handpainted with most remarkable care and exactitude, giving an extreme delicacy of tone and a clear outline of each figure on a rural back ground, treated with a deep feeling for natural beauty. This copy is perfectly preserved and without any defect. It is in fact a fresh edition of the CH'IEN LUNG period made throughout with the K'ANG HSI original blocks, to which have been added poems by the Emperors YUNG CHENG (1723-1735) and CH'IEN LUNG (1736-1795), both of whom desired to follow the example of their illustrious ancestor and to compose a poem for each of the pictures.

The work consists of two large volumes in album form, enclosed in a covering of richly adorned silk with clasps of carven ivory. This in its turn is ingeniously contained in a wooden case bearing the inscription " *K'ang Hsi yü chih kêng chih t'u,* i. e. " Pictures of agriculture and weaving, Imperial edition of K'ANG HSI. " The first illustration shows the casket just described.

Each volume is bound in a double covering of stout boards, the second being faced with a handsome brocade. The second illustration shows the brocaded cover of the second volume. The inscription on the left hand side is in manuscript and the title is identical with that on the casket. The three lines in small characters below the title run as follows *" Hsia ts'ê chih t'u êrh shih san yüeh tê yü chang an kung chieh ho yüan*

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(1) *Shê jih*, days of sacrifice, coming once in the spring before seed-time, and again in the autumn after harvest. They were sacred to the Earth, personified as the tutelary deity of the soil.

(2) MAURICE COURANT (p. 145 sq. of the second volume of his " Catalogue des livres chinois, coréens et japonais de la Bibliothèque Nationale de Paris ", 1903) describes very briefly certain copies of the *Kêng chih t'u* (nos. 2394-2398) but it does not seem possible that any of these were based on the original plates of K'ANG HSI. They differ entirely from our work in form or other essential points. The same is the case with the copy in the National Museum of Natural History of New York and that in the Konigliche Bibliothek of Berlin. These last are slightly more in accord with our copy, which is however greatly superior both as regards technical execution and state of preservation.

shih ts'ang chên" i.e. "IInd volume, weaving, 23 pictures; which became the property of the Archives of GHANG-AN in the third month of the spring season of 1753 and was preserved among the treasures of. HO YÜAN [pseudonym], (whose red seal is affixed)." The same legend is also to be seen on the cover of the first volume with of course the exception of the number and subject. These markings lead to the conclusion that the work was produced at a date previous to 1753 and probably between 1736 and 1742, that is to say, before the Emperor CH'IEN LUNG gave orders for the engraving of the plates for the edition issued under his control (1). The two albums are 3 ½ cm. thick and almost square is shape, being in fact 28 cm. wide by 26.8 cm. long.

In the first volume two blank pages are followed by six which contain Emperor K'ANG HSI's preface, of which a translation has already been given. This preface is a facsimile, printed in red, of the original hand writing of the Emperor. On the first page (fig. 3) in the right hand lower corner is to be seen a manuscript inscription in black characters, meaning "Preserved as a precious relic in the "Pavilion of Serene Peace," (*An ching t'ing chên ts'ang*). The red rectangular seal (*Kuan fang*) of the command of a western expeditionary force (2) has been stamped by hand over the inscription.

The pictures on agriculture are found immediately after the preface and all are on the page to the right hand of the reader, while the text of the Imperial poems is on the opposite page. Each of the pictures measures 24.5 × 24.7 centimetres, and has a black line border. In one of the blank corners, or, where all the corners are occupied by the drawing, in any available blank space, the original poem of LOU SHOU on the subject of the picture is inserted. The poems of LOU SHOU are in 8 verses of five monosyllables apiece.

The text of the Imperial poems takes up the page to the left of the picture to which it relates and is framed in a red border, 3 centimetres wide. The space occupied by the text is broken up into 8 columns, lettered in red, and is 18 × 19 centimetres wide.

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(1) A very detailed study of the *Kêng chih t'u* and more particularly of the Edition of *Ch'ien Lung*, has been published by O. FRANKE in a volume entitled: "*Kêng chi t'u, Ackerbau und Seidengewinnung in China,*" Hamburg, 1913. The eminent French authority on China, PAUL PELLIOT, has contributed a masterly footnote to O. FRANKE's important monograph by his erudite article "A propos du *Kêng tchê t'ou*" which is published in the "*Mémoires concernant l'Asie Orientale,*" Vol. I, Paris, 1913.

(2) The same seal occurs on the page of the text corresponding to the 23rd picture in the first part, and on the 1st, 2nd and 23rd pictures and corresponding pages of the text in the second. On the first picture in the second part (fig. 7) the print of the seal is particularly clear and runs thus: *Kuan tai hsi chêng hsüan fêng yang p'ao chang hsü tui shih kuan fang,* which may be roughly translated: "Command of the expeditionary force against the rebels of the West. Front line. Regiment of Western Artillery and Dragoons, Official seal." It would be interesting from the point of view of the history of the Album to be able to identify the various persons into whose possession it came, following the line of the various inscriptions referred to above.

The first column to the right indicates the section, the number of the picture in the series and its title. The second and the third columns contain the poems of the Emperor K‘ang Hsi in 4 verses of 7 monosyllables apiece. In the fourth, fifth and sixth columns is given the poetry of the Emperor Yung Chêng in 8 verses of five monosyllables a piece following exactly the model of Lou Shou. The poems of Emperor Ch‘ien Lung, which are in the same metre as those of K‘ang Hsi, are to be found in the seventh and eighth columns, but none of the poems bears any indication of the author. At the end of the first volume in the lower corner to the right in picture 23, immediately after the verses of Lou Shou, is inscribed the name of the painter, Chiao Ping Chêng, who styles himself Secretary of the Imperial Bureau of Astronomy. The same inscription is to be seen in the lower left hand corner of picture 23 at the end of the second volume. The pictures and the text in the second volume are arranged in the same manner as those in the first

The first volume is devoted to agriculture (*kêng*) or, more correctly, rice-culture, from the period of sowing to that of Harvest Thanksgiving. The second volume is devoted to weaving (*chih*) that is to say the rearing of the silkworm and the completion of the fabric.

Below are given the titles of the various pictures with brief notes of explanation.

First Part. — AGRICULTURE (*Kêng*).

1. *Ch‘in-chung*	Immersion of the Grain.
2. *Kêng*	Ploughing.
3. *P‘a-nou*	The first harrowing, by a rigid harrow with three rows of teeth, ridden by the worker.
4. *Ch‘ao*	The second harrowing, by a harrow with a single row of teeth and a vertical frame held in the hand.
5. *Lu-tu*	The third harrowing, by a light harrow with three rows of teeth.
6. *Pu-yang*	The sowing.
7. *Ch‘u yang*	The first sproutings.
8. *Yü-yin*	Manuring. As soon as the shoots appear, a small trough attached to a rod is used for this purpose.
9. *Pa-yang*	Raising the seedlings.
10. *Ch‘a-yang*	Pricking out the seedlings.
11. *I-yün*	First weeding.
12. *Erh-yün*	Second weeding.
13. *San-yün*	Third weeding.

14. *Kuan-kai*	Irrigation, by a hand-windlass.
15. *Shou-i.*	Cropping.
16. *Têng-ch‘ang*	Grinding.
17 *Ch‘ih-sui*	Threshing with double flail.
18. *Ch‘ung-tui*	Pounding with pestle and mortar
19. *Shai*	Sifting.
20. *Po-yang*	Winnowing
21. *Lung*	Cleansing.
22. *Ju-ts‘ang*	Storing in the granary.
23. *Chi-shên*	The Harvest Thanksgiving.

SECOND PART. — WEAVING (*Chih*).

1. *Yu-ts‘an.*	The bathing of the silkworms' eggs.
2. *Êrh-mien*	The second sleep.
3. *San-mien*	The third sleep.
4. *Ta-ch‘i*	The great awakening.
5. *Cho-chi*	Maturity. The fully developed worms are taken out by means of nets, and the weaklings are rejected.
6. *Fên-po*	Bedding-down.
7. *Ts‘ai-sang*	Plucking the mulberry leaves.
8. *Shang-tsu*	Mounting the silkworms.
9. *Chih-po*	Heating the trays.
10. *Hsia-tsu*	Extracting the cocoons.
11. *Tsê-chien*	Sorting the cocoons.
12. *Chiao-chien*	Care of the cocoons.
13. *Lien-ssŭ*	Winding off the silk on the frames.
14. *Ts‘an-ê*	Mating the moths.
15. *Ssŭ-hsieh*	Thanksgiving to God.
16. *Wei*	Making the weft.
17. *Chih*	Weaving.
18. *Lo-ssŭ*	Making the skeins.
19. *Ching*	Making the warp.
20. *Jan-sê.*	Dyeing.
21. *Pan-hua*	Weaving embroideries.
22. *Chien-po.*	Cutting up the finished silk.
23. *Ch‘êng-i*	Garment making.

A few reproductions of the drawing with the text of the accompanying poems are appended.

The first picture in the first part of the *Kêng chih t'u* (fig. 5) represents the watering of the seeds, the first task of the agricultural year. In the early days of April, baskets containing the seed are dipped in the stream flowing past the peasant's cottage in order that the action of the water may develop its power of germination. In the left hand corner is LOU SHOU's poem of which the following is the text and a translation.

CH'IN CHUNG

Ch'i t'ou yeh yu tsu
Mên wai ch'un shui shêng
Yün lan ch'in ch'ien pi
Chia ku ch'ou hsin mêng
Hsi ch'ou chiang yu shih
Lei ssŭ sui ch'ên hsing
Chih chi chi kou mang
Tsai pai ch'i ch'iu ch'êng

IMMERSION OF THE SEEDS.

" Last night on the mountain, whence springs the stream, were rains abundant.
At our door the spring floods have swelled the brook.
Now plunge we our frails in the shallow green waters.
So that the bountiful seed may send out its tender shoots
In the fields of the West toil now begins,
And the ploughshare follows the course of the rising sun.
To the God of Spring we sacrifice a cock, (1)
And pray once more that in the Autumn time we may reap rich harvest. "

Fig. 4 gives a reproduction of the page of the text corresponding with Picture I. It contains the poems of K'ANG HSI, YUNG CHÊNG and CH'IEN LUNG of which a rough version is given:

K'ANG HSI's poem:

Hsüan ho chieh hou chao nung kung
Tzŭ t'zŭ ch'in lao ch'i ch'u t'ung
Tsao pien tung t'ien t'ung lu chung
Ch'ien shang shê shui ch'in yün lung

" The toil of the field begins as mild, and balmy grow the days.
Now all around with equal zeal men start to work
Early in the day, for the Eastern fields seed slow and quick of growth is chosen
The peasants barelegged step down into the stream to dip their frails. "

---

(1) " KOU MANG " is the protective Genius of the Spring

YUNG CHÊNG poem:

Pai ku i chia chung
Hsien nung chu mou kung
Ch'un hsüan êrh yüeh hou
Hsiang ch'in i ch'i chung
Chung lu sui i pien
Yün lung yung li t'ung
Mei to hsien fu lao
Chan chieh shih nien fêng

" The fruitful seeds given by last year's crops
Safeguarded by the Divine *Shên Nung*, (1)
In the third month, in Spring's warm days,
Are plunged in the sweet-smelling stream.
The slow growths and the quick are chosen,
And all together grasp the frails,
What time the village grey beards
In fullness of knowledge predict a year of abundance."

Poem of CH'IEN LUNG:

Ch'i pu ching yang tsao hua kung
Tung chiao shu tsai wan fang t'ung
Ch'i liu ch'in chung ju yu lu
Shêng i han ch'un hsiu sê lung

" The creative influences of Spring are spreading through the air.
Eastwards in the country round about the city, field work is on all
sides beginning.
The grain is being dipped in the stream, flowing down from the
mountain and now green as oil.
Spring's joy is all pervading and the grain frails are fair to see ».

Fig. 7 depicts the first process in silkworm rearing, the bathing of the eggs before hatching out, which takes place in mid-April.

LOU SHOU's poem, which is to be seen in the upper right-hand corner, and the page of text corresponding with the picture which contains the poems of the three Emperors on the same subject may be rendered as follows.

---

(1) SHÊN NUNG (2852-2737 B. C.), the Divine Husbandman, was one of the five first legendary rulers of China. Tradition ascribes to him the discovery of the plough, and also the instruction of his people in the art of cultivation and the use of medicinal herbs He is regarded as the tutelary Divinity of Agriculture.

LOU SHOU's poem:

YÜ TS'AN.

Nung sang chiang yu shih
Shih chieh kuo chin yen
Ch'ing fêng kuei yen jih
Hsiao yü yü ts'an t'ien
Ch'un shan chüan kao mei
Pên ch'ih lung ch'ing ch'üan
Shên kung hsiang chai chieh
Kung sang shuai min hsien.

THE BATHING OF THE SILKWORMS'EGGS.

" The field worker's and the silk worker's toil is now beginning,
For the days when no fires may be lit are past (1).
When gently blows the breeze and the swallows return,
And lightly fall the spring showers, then is the time to cleanse the silkworms' eggs.
So turn back the sleeves of your white Spring garments,
See how the water in the vessel gleams crystal-clear.
In the Imperial Palace strict fast is kept,
And, for an example to his folk, the Emperor himself tends the mulberries "

K'ANG HSI's poem:

Pin fêng ts'êng chu shou i pien
Ts'an shih sh'u hsing ku yü t'icn
K'êng k'ao kung sang ch'uan li chih
Hsien i yu chung hsiang ch'ing ch'uan.

" As hath been already set forth in the chapter " on clothing " in the " Customs of PIN "
Silkworm rearing begins on the " Ku yü " day (2)
Moreover it is laid down in the rules of the Book of Ritual (3), in the passage on the Ducal mulberry trees,
That the first task is to plunge the eggs in the sunlit waters of the stream. "

---

(1) "*Chin yen*", i. e. the period when no fires were allowed, came round towards the end of spring or at the end of the 3rd month of the Chinese year. For several days the lighting of fires and all cooking were forbidden.

(2) "*Ku yü*" (literally "grain rains") is a solar term corresponding with the 20th of April when the Sun enters the Constellation of Taurus.

(3) The *Li Ki*, or Book of Rites, is one of the texts of the teachings of Confucius in which is collected all the information relating to the ceremonies, rites and customs, both civil and religious, practised by the Chinese of ancient times.

YUNG CHÊNG's poem:

Men to yang liu fêng
Ch‘i chang t‘ao hua shui
Ts‘un chiu yun yang kao
Ch‘un kuei yu ts‘an tzŭ
Hsien hsien lung ts‘ui p‘ên
Ch‘i ch‘i juan hsiang chih
Hsüeh chien yu ping ssŭ
Fu kung ts‘ung tz‘ŭ shih.

"When among the willows before the house the breezes blow gustily
And the steamlet issuing from the mountain is swollen and noisily flow its waters, now coloured as the peach bloom,
The village keeps solemn festival with lamb's flesh and wine,
While in the rooms of the women the silkworms' eggs are cleansed.
Then fair hands hold the basin, turquoise green,
And in it are poured the eggs from the scented packet.
Later from the cocoons all snow white, silk icy white will be woven,
Now the tasks and the toils of the women begin."

CH‘IEN LUNG's poem:

Ts‘êng tu pin fêng ch‘i yüeh pien
Ch‘ih ch‘ih jih ting li kuang t‘ien
Hsin ts‘an wei ch‘i hsien i yu
P‘ên man ming pi jên man ch‘uan

"It is written in the chapter "on the 7th month" in the "Customs of PIN",
When the shadows grow longer and the sky shines bright,
The yet-unhatched and tender silkworms' eggs are cleansed
In basins filled with the clear waters of the stream, where all the folk are gathered round."

A characteristic picture representing a stage in rice-culture, the pricking out of the seedlings, has also been chosen for reproduction. From the most remote age this practice has existed in China, though with us it has been followed in quite recent years only and is not as yet general. The poem of LOU SHOU on the subject is to be seen in the upper right-hand corner. It runs as follows:

CH'A YANG

Ch'en yü mai ch'in jun
Wu fêng huai hsia liang
Ch'i nan yu ch'i pei
Hsiao ko ch'a hsin yang
P'ao chih pu t'ing shu
Tso yu wu luan hsing
Wo chiao ch'a yang ma
Tai lao min mo wang.

PRICKING OUT THE SEEDLINGS.

" In the mouth of May the dawn showers bathe the soil,
And the South Wind keeps the summer days cool as it rustles the acacias.
To South and to North of the streamlet that comes down from the mountain,
With jest and song the country folk prick out the rice-seedlings.
Stooping to earth and never remitting in their toil,
They move steadily to right and left.
I will teach you to do the work with a tool of wood:
This will lighten your toil; give heed to my instruction." (1)

⁂

The works presented by his Excellency, M. LU, form a worthy complement of the gift of the President of the Chinese Republic. They comprise:

1) *Nung chêng ch'üan shu*
2) *Ch'in ting shou shih t'ung k'ao*
3). *Chih wu ming shih t'u k'ao.*

A brief summary of these three works follows.

The *Nung chêng ch'üan shu* is a complete treatise on Agriculture in sixty volumes (*chüan*) and the classical work on agriculture for the Ming dynasty (1368-1644). The author was HSÜ KUANG-CH'I (1562-1633) the famous pupil of the Jesuit father, Matteo RICCI, under whose influence he was converted to Catholicism.

From the biography of the author which appears in the History of the Ming Dynasty (book 251, folio 15), we learn that HSÜ KUANG-CH'I held a very high place in public life. Hence it is not surprising that his conversion raised the highest hopes among the missionaries, who at his baptism wished to give him the name of Paul, to indicate the

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(1) A description of this tool as used in the rice-field is given in the *Nung-chêng-ch'üan-shu*, book 21, 19th folio (front and back).

Apostolic service that they expected from him in China. Their hopes were however doomed to disappointment for Hsu Kuang-ch‘i remained for all time the only example of a Catholic convert among high Chinese functionaries. However in his writings he gave currency to the European scientific knowledge that he had acquired as a result of the instruction he had received from his Jesuit instructors

Hsu Kuang-ch‘i died before he had quite completed his treatise on Agriculture which was not published till 6 years after his decease. Although according to the History of the Ming Dynasty (Ming shih, book 251 folio 17 front) the question of an Imperial Edict ordering the work to be printed was raised, no Imperial Edition of the book has been discovered. Probably the internal struggles which a little later brought about the fall of the Ming Dynasty prevented the carrying out of the Imperial order. The fact remains that the *Nung chêng ch‘uan shu* as appears from the Imperial Catalogue of Ch‘ien Lung (*Ch‘in-ting-sŭ-k‘u-ch‘üan-shut-sung-mu*, book 102, folio 15 back) was printed by Ch‘ên Tzû-lung, who received it from one of Hsu’s uncles, Chang Kuo-wei and Fang Yo-kung, who were all high State dignitaries. The first edition made its appearance in 1639. It contains the preface and the notes of the three editors named above, who were contemporaries of Hsu-Kuang-ch‘i. He himself was a native of Shanghai, close to which is to be found even to this day a famous Jesuit Community in a district which takes its name from the Hsu family (*Zikawei* [Hsŭ-Chia-Wei] = Villa of the Hsu family).

Hsu Kuang-ch‘i’s work, which is truly a monumental record of Agricultural science in the days of the Mings, has had an enormous circulation throughout China and has run into numerous editions.

The copy presented to the Institute by his Excellency was printed in the first half of the year 1800.

The library of the Institute possesses a second copy, presented by the Chinese Government in 1909. It is a reprint dated 1843 (the 23rd year of the reign of Tao Kuang) edited by T‘ai Yuan Shih and published by the house of *Shu-hai-lou* at Shanghai.

The *Nung Chêng ch‘üan shu* is in effect a most carefully produced Encyclopaedia of Agricultural Science. In it the subject is considered in its scientific and practical aspects, not merely as affecting the agriculturist alone, but rather from a wider and more general point of view as a form of Political Science, the base and foundation of a complete system of government. Herein lies the most original and important characteristic of the work of Hsu Kuang-ch‘i, who, taking as his standpoint the old classical idea that “ Agriculture is the basis of the Empire and the greatest and most useful of the Arts ”, considers that a treatise on agriculture viewed generally should keep in view the realisation of the well-being and comfort of the people, and aim at guaranteeing their freedom from disturbance and the maintenance of a Government resting on solid foundations

A brief summary of the contents of the treatise shows that the first

3 books (*Nung-pên*) deal with agricultural literature from the earliest down to the author's own period. It contains numerous quotations from the classics and also from the scientific publications of the most famous writers. A historical study is also given, showing the great importance paid at all times by the different Chinese Dynasties to questions relating to Agriculture in general.

Books 4 and 5 (*t'ien-chih*) deal with the land-systems and the distribution and classification of estates.

Books 6 to 11 (*nung-shih*) describe field-work.

Books 12 to 20 deal with Hydraulics and Irrigation. Here for the first time European hydraulic science is referred to in a Chinese book. HSÜ KUANG-CH'I gives a partial reproduction of the treatise on hydraulics which he himself wrote at the dictation of Father SABATINO DE URSIS which had already been published in six volumes under the title of *T'ai hsi shui fa* (1). Part of the 4th, and the 5th volume are omitted as being purely speculative and theoretical.

Books 21 to 24 (*nung-ch'i*) contain a complete description of the various agricultural implements and machines with explanatory matter and numerous drawings.

Books 25 to 30 (*shu-i*) treat of the cultivation of the chief crops; cereals, vegetables, fruit-trees, etc.

Books 31 to 34 (*ts'an-sang*) describe at length the cultivation of the mulberry and the breeding of silkworms. In particular in books 33 and 34 are to be found a number of drawings of the "plant" used in silkworm breeding and also for spinning and weaving the silk.

Books 35 and 36 (*ts'an-sang-kuang-lei*) give a detailed account of the modes of cultivating cotton, hemp, flax and the fibres of *Pueraria Thumbergiana*. Book 35 has been translated into English in the "Chinese Repository" (vol. XVIII, 1849) pp. 449 under the title of "Directions for the cultivation of cotton."

Books 37 to 40 (*chung-chih*) have reference to forest-trees, such plants as tea, chrysanthemum, bamboo and those used for dyeing.

Book 41 (*mu yang*) is on the subject of cattle-breeding, while book 42 (*chih-tsao*) treats of the conversion of agricultural produce into foodstuffs, oils and alcoholic beverages.

Books 43 to 60 (*huang-chêng*) are devoted in great detail to general policy with regard to the distribution of foodstuffs and in particular to the measures that should be taken to avoid and to combat famine and other calamities resulting from natural causes.

A section of book 44 on the subject of locusts has been translated into Italian by Alfonso ANDREOZZI, who published at Florence in 1870 a little volume with the title: "Sulle cavallette, considerazioni estratte dal *Nun' cen'-ziuen-sciu*, ossia Trattato completo sull' Agricoltura. — Firenze, 1870."

This Section of the treatise contains complete lists of all the grasses,

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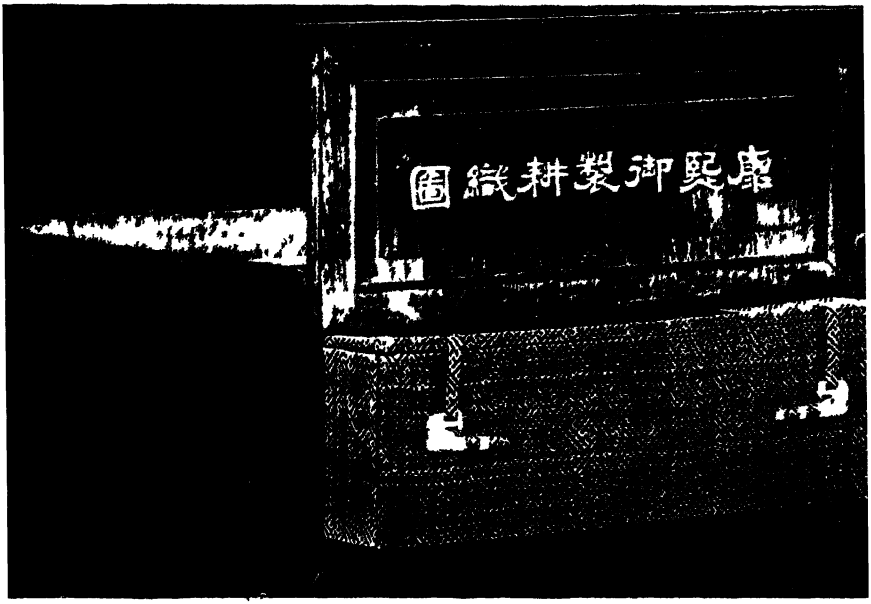
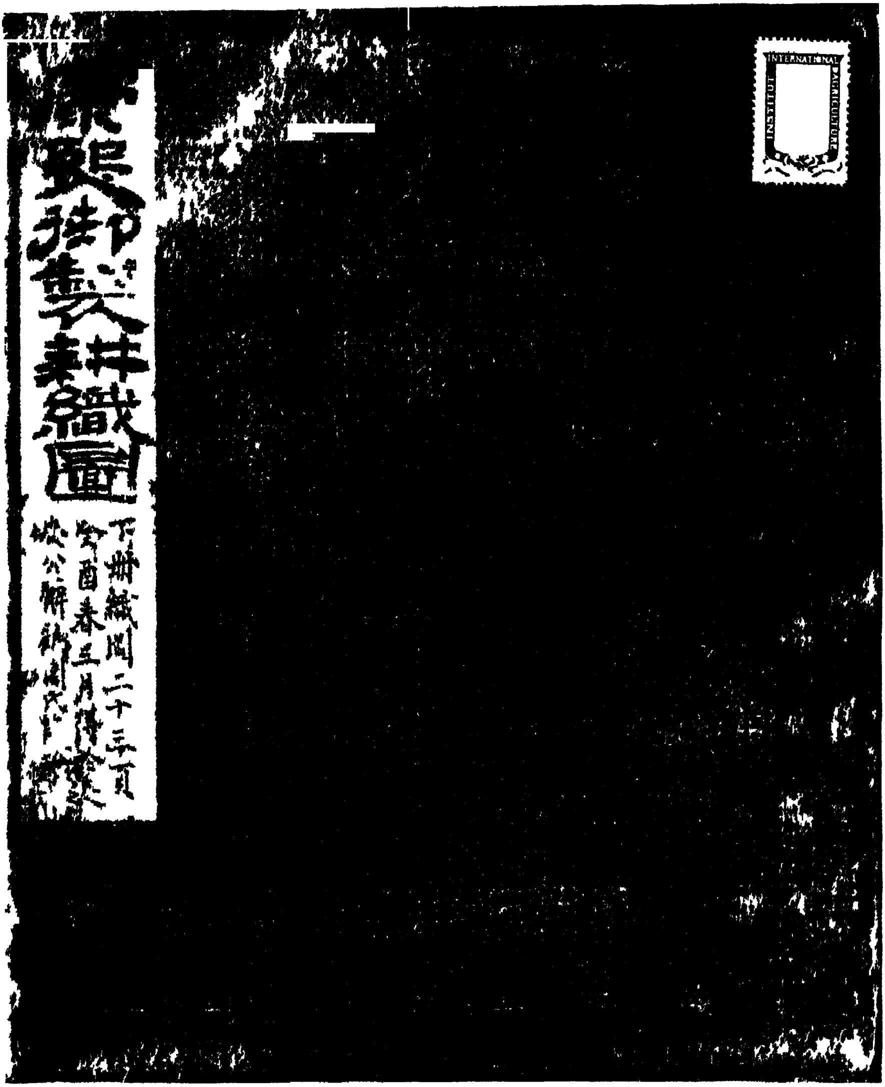
(1) See CORDIER, *Imprimerie sino-européenne*, 314.

FIG I



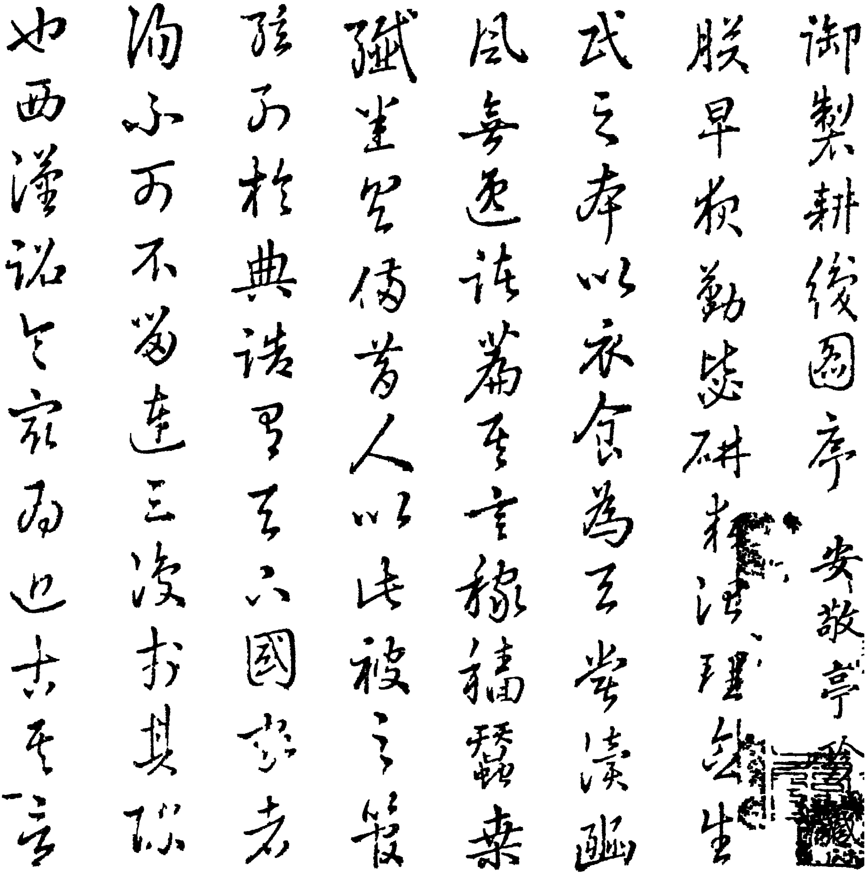
THE COFFER CONTAINING THE “*K‘ang hsi yu chih kêng chih t‘u*”

FIG. 2



THE BROCADE COVER OF THE SECOND VOLUME OF THE *K'ang hsi yu chih keng chih t'u*

FIG 3

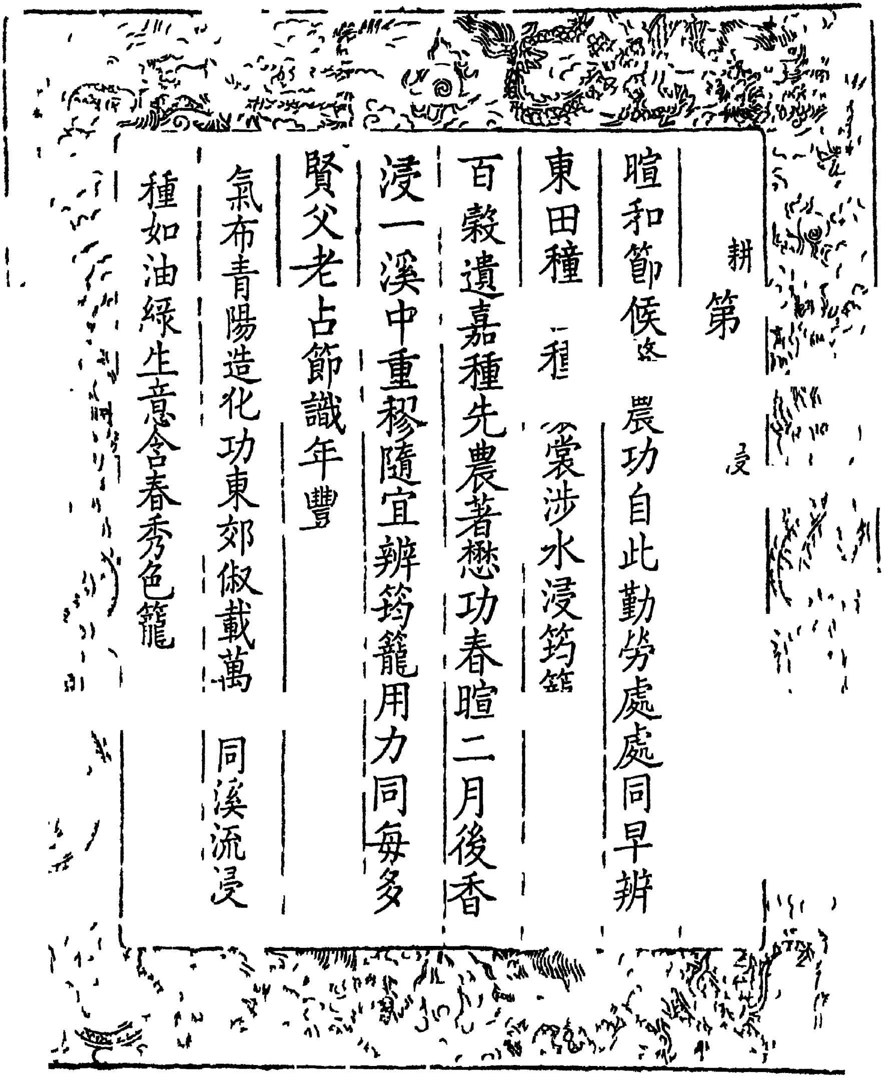


御製耕織圖序　安敬亭

朕早夜勤毖研求治理念生民之本以衣食為天嘗讀豳風無逸諸篇其言稼穡蠶桑纖悉備具昔人以此被之管弦播諸典誥有天下國家者洵不可不留連三復於其際也西漢詔令最為近古其言

THE FIRST PAGE OF THE PREFACE OF THE EMPEROR K'ANG HSI

FIG 4



耕第　浸

暄和節候肇　農功自此勤勞處處同早辨

東田種　稑　簑涉水浸筠籠

百穀遺嘉種先農著懋功春暄二月後香

浸一溪中重穋隨宜辨筠籠用力同每多

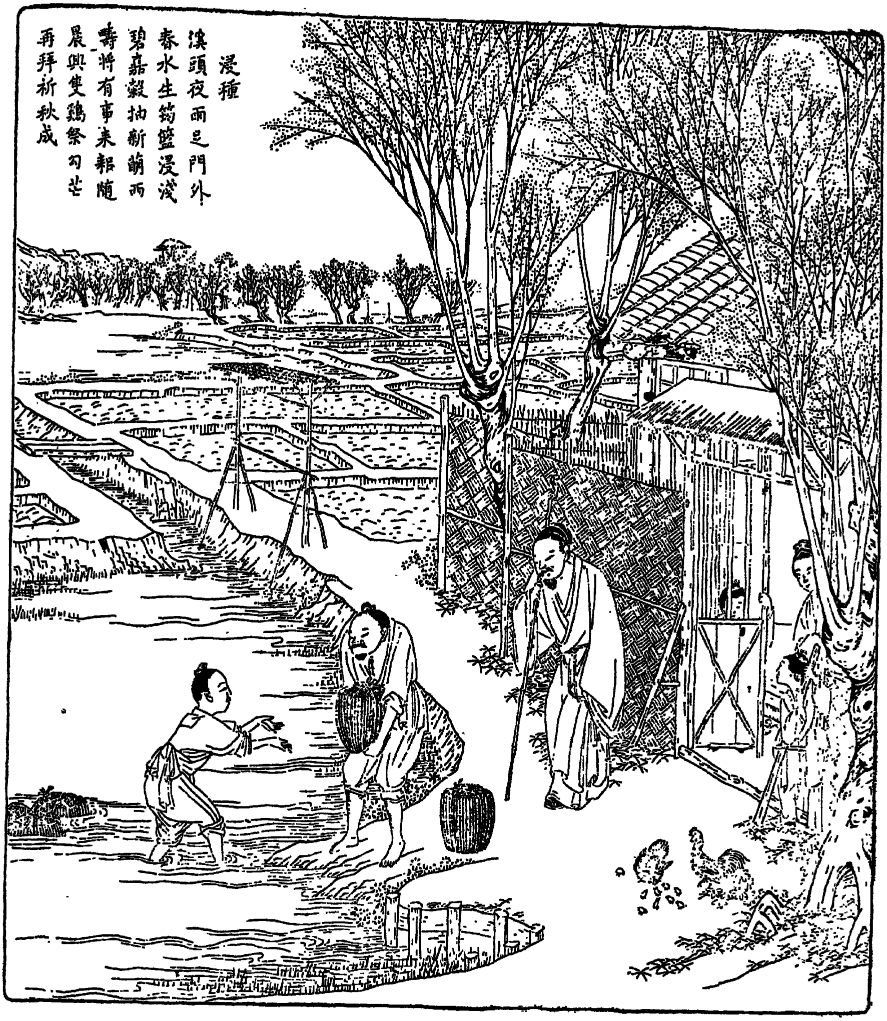
賢父老占節識年豐

氣布青陽造化功東郊俶載萬　同溪流浸

種如油綠生意含春秀色籠

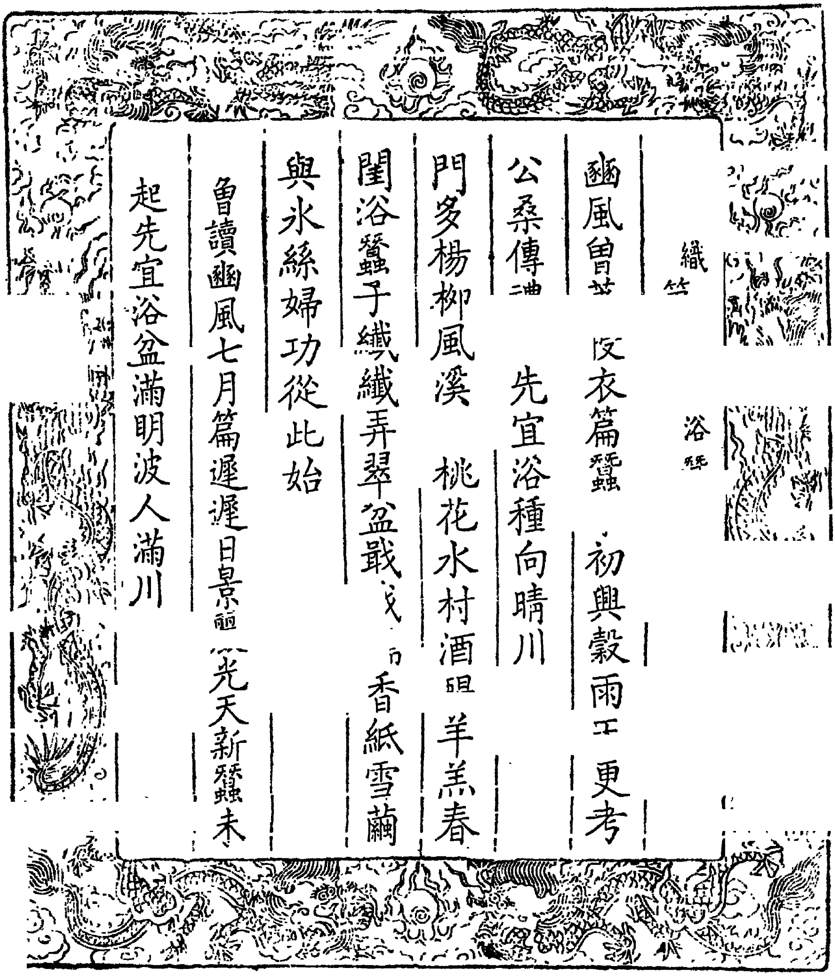
THE TEXT OF THE VERSES BY K'ANG HSI BY CHÊNG AND BY CH'IEN LUNG CORRESPONDING TO THE PICTURE REPRODUCED IN FIG 5

FIG. 5.


浸種
溪頭夜雨足門外
春水生筠籃浸淺
碧嘉穀抽新萌西
疇將有事耒耜隨
晨興隻雞祭勾芒
再拜祈秋成

FIRST PICTURE OF THE FIRST PART, CULTIVATION, "*Ch'in chung,*" THE SOAKING OF THE SEED.

Fig. 6.



織（第）　浴（蠶）

豳風曾（茲）　攷衣篇（蠶）　初興穀雨（工）　更考

公桑傳（油）　先宜浴種向晴川

門多楊柳風溪　桃花水村酒（旦）　羊羔春

閨浴蠶子纖纖弄翠盆戢（戈）（口）　香紙雪繭

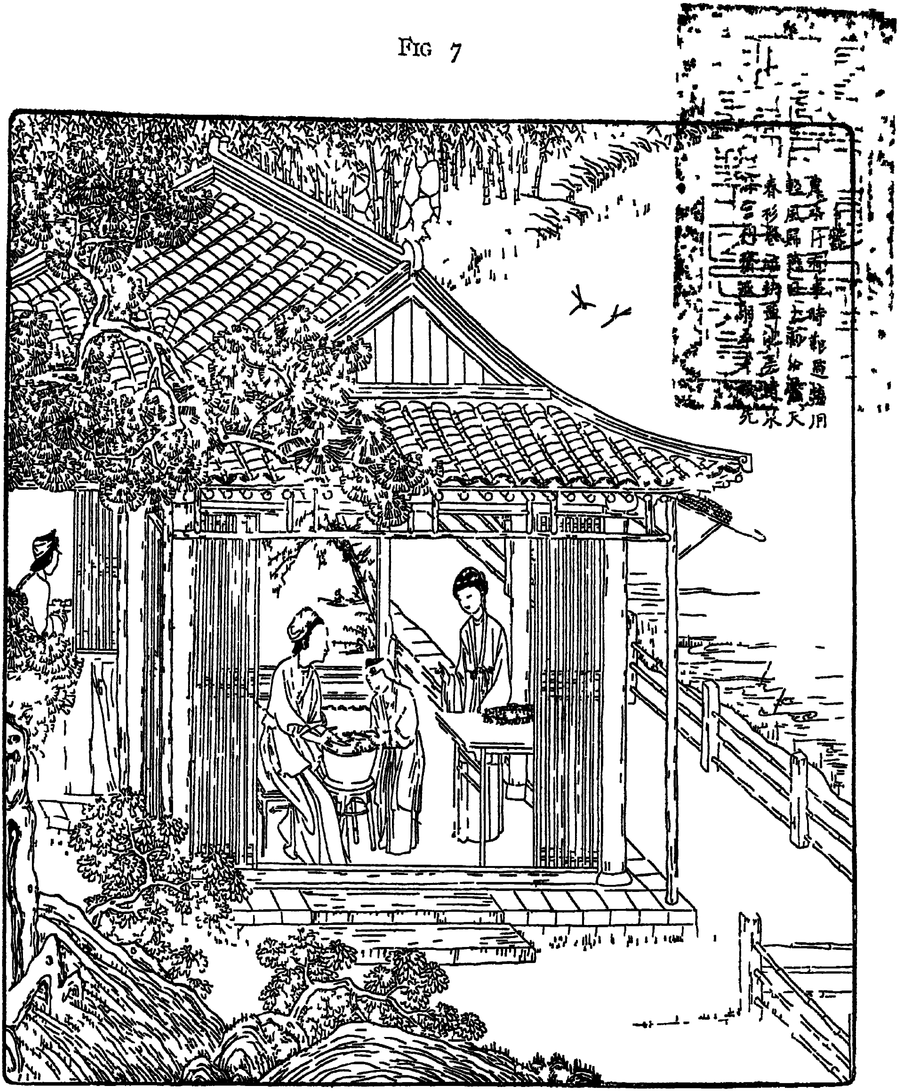
與冰絲婦功從此始

曾讀豳風七月篇遲遲日景（麗）（八）光天新蠶未

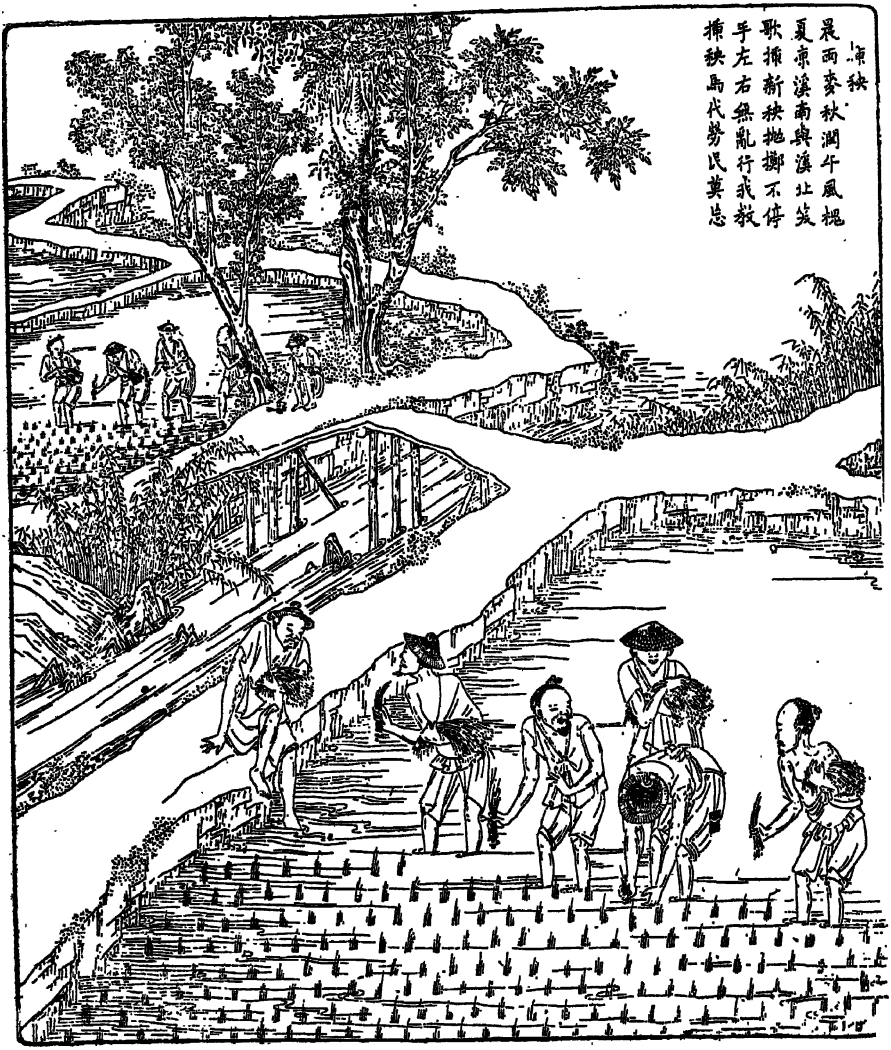
起先宜浴盆滿明波人滿川

Text of the Verses by K'ang Hsi, by Yung Chêng and by Ch'ien Lung corresponding to the Picture reproduced in Fig. 7.

FIG 7



First Picture of the Second Part Weaving, *Yu ts'an*," Washing the Silkworm Eggs


揷秧
晨雨麥秋潤午風槐
夏凉溪南與溪北笑
歌揷新秧拋擲不停
手左右無亂行我教
揷秧馬代勞民莫忘

TENTH PICTURE OF THE FIRST PART, CULTIVATION, "*Ch'a yang*," TRANSPLANTING RICE SEEDLINGS.

plants, fruits, vegetables, etc. that can be eaten in times of famine with an illustration and a description of the method of treatment in each case

⁂

The *Ch'in ting shou shih t'ung k'ao* is the chief work on Agriculture produced by the Ch'ing Dynasty (1644-1912) following the example of the treatise of HSU KUANG CH'I. It was set on foot by the Imperial decree of the Emperor CH'IEN LUNG (1736-1795) through an official committee, with a Prince of the blood royal as President, consisting of fifty members of acknowledged scientific eminence, among whom were to be found some of the chief dignitaries of State.

By an Edict of the 14th of May, 1737, the Emperor CH'IEN LUNG gave orders that the work should be carried out in order to give an impetus to agriculture in the Empire and to demonstrate to his people that it was a matter of the deepest concern to the highest authority in the land. The work was finished in 1742 and presented with a note to the Emperor, who himself added a preface.

The title is distinctly characteristic of the Ch'ing period — one of remarkable scholarship, more imposing on account of the vastness of its literary output than of its intrinsic value. While the titles of previous works are clear and comprehensive, it is impossible to understand the title in this case without reference to its original source. In the " Book of History " (*Shu-ching* i, 2), a classic of the highest antiquity, it is stated that the Emperor YAO (2357-2255 B. C.) ordered the astronomers HSI and HO to draw up the Calendar " paying all due respect to the God of Heaven " in such a way " as to make the march of the Seasons quite evident to the folk " (*Ching-shou-jên-shih*).

The treatise opens with this phrase of *Shu-ching's* to be understood in the sense that " the seasons for mankind are the periods for fixed labour and for harvesting " and that " the precise definition of the seasons is the foundation of all agricultural work. "

Hence the title really signifies " Enquiries into the true significance of the seasons ", that is to say, into the types of fixed labour appropriate to the various stages of the year. As regards the actual value of the treatise it hardly appears to be so important as that of HSÜ KUANG-CH'I. In reality it is largely a reproduction of earlier work with certain additional matter but without criticism or originality. It attaches great importance to the encouragement of agriculture by the State and to religious festivals connected with husbandry. The whole is copiously illustrated, HSÜ's designs being supplemented by a large number of modern and original engravings.

The edition which has been presented by his Excellency is undated, but in all probability belongs to the later half of the year 1800.

The Library also possess a second copy of the treatise, the Imperial Edition of 1826 (sixth year of the reign of TAO KUANG), the gift of the Chinese Government in 1909.

Below will be found a short summary of the contents of the 78 Books (*chüan*).

Books 1 to 6 (*t'ien-shih-mên*) deal with the subjects of climate and seasons.

Books 7 to 18 (*t'u-i-mên*) treat in great detail questions relating to the land system and distribution of estates, irrigation, etc.

Books 19 to 30 (*Ku-chung-mên*) deal with the cultivation of cereal crops and volumes 31 to 41 (*Kung-tso mên*) with various forms of field-labour and harvesting, illustrations of the implements and machines employed being also given.

Books 42 to 53 (*ch'üan-k'o mên*) describe the different forms of encouragement given to agriculture by the Government, various Imperial edicts, poems, public ceremonials in honour of agriculture, etc. In volumes 52 and 53 are reproduced the drawings of agriculture and weaving given in the *Kêng chih t'u* described in detail above.

Books 54 to 57 (*hsü-chü-mên*) contain much interesting information upon the State granaries, which in general should serve, not only for charity or for dealing with famine conditions when they arise, but also for regularizing the market.

Books 58 to 71 (*nung-yü-mên*) deal with the crafts subsidiary to agriculture, such as horticulture, sylviculture and cattle breeding.

Books 72 to 78 (*ts'an-sang-mên*) are concerned with silkworm-rearing and the cultivation of the mulberry. They have been in part translated by STANISLAS JULIEN in his well known book entitled « Résumé des principaux traités chinois sur la culture des mûriers et l'éducation des vers à soie », published in Paris in 1837.

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The *Chih wu ming shih-t'u k'ao*, or Illustrated Index to the Vegetable Kingdom, is the work of the famous botanist WU CHI-'CHÜN (d. 1846) of Ku-shih, in the province of Honan.

This Catalogue gives a careful classification and a very detailed description of all plants.

Before publication, the whole work was carefully revised by another celebrated botanist LUNG YING-KU of Mêng-tzu in the province of Yünnan.

The edition presented by his Excellency, LU CHÊNG-HSIANG bears the date of 1919. It was issued by the Official Printers of Shanhsi, the province of which the author was viceroy for many years, but was originally written in the first half of 1800. The Library possess a second copy, which was printed in 1866.

The treatise is in 38 volumes, with an appendix of 22 additional volumes.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

879 - **The Progress of Agriculture in the Republic of Cuba During Recent Years.** — *Communicated by* DR. F. F. FALCO, *Delegate for Cuba to the International Institute of Agriculture.*

General Statistical Information. — The following data have been furnished by the special Bureau of Information of the Ministry of Agriculture, Commerce and Labour of the Republic. The demographic and commercial portions relate to the year 1920.

The Island is about 750 miles long, and the area is 45 881 sq. miles. The sea coast of Cuba is about 3700 km.; it has more deep-water ports than any other country in the western hemisphere. The mean temperature in January is 21.3° C; and in July 28° C; extremes vary from 17° C to 39° C. The average rainfall is 137 cm., the climate is dry in winter, but there is heavy rain in summer. There is a population of 2 900 000 inhabitants; or a density of about 24 per sq. km.

Excess of births over deaths	45 000
Average annual immigration	45 000
Average annual increase	90 000

74 % of the population is white, 26 % coloured.

Foreign Trade: — Total	$	890 000 000
Exports	»	590 000 000
Imports	»	300 000 000
Balance of trade in favour of Cuba	$	290 000 000
Balance of trade per head	»	100
Re-exports from Cuba per head	»	203
Imports into Cuba per head	»	108

[Information N° 879]

In normal times more goods enter and leave the Port of Havana than any other Western Hemisphere port except New York.

The value of the sugar crop of 1918-19 was $524 000 000, and the estimated value of the sugar crop 1919-20 is $1 080 000 000. The total tobacco crop was valued at $50 000 000.

Citrus plants, pine apples, vegetables, cocoa and honey produced $4 000 000. Cabinet woods and dyewoods yielded $1 000 000. Cattle, hides, etc., yielded $3 000 000, and iron, copper manganese and asphalte $12 000 000.

Since the establishment of the Cuban Republic (1902), the foreign trade has increased by over 700 %, and the exports have increased by 228 % since 1915.

The cost of land depends on the situation, quality and size of the lot. Prices vary from $15 to $500 per acre.

Sugar cane. — The chief agricultural product of Cuba is the sugar cane, The annual production is as much as 4 000 000 tons, divided among about 200 factories called *centrales* and *ingenios.*

Almost all the sugar cane is grown without artificial irrigation, but for some time taking water from the sub-soil and using it for irrigation have been in successful operation and in several plantations more abundant crops have thus been obtained.

Compared with other countries where sugar cane is grown, Cuba has the advantage of having plants of exceptional longevity. Sugar cane planted on virgin soil in Cuba can be cropped for 30 successive years without having to replant, and in any case the cane-fields remain productive for 6 to 20 years ; total replanting is not required and it suffices to replace plants which die from time to time.

The cane is propagated by cuttings, that is to say by pieces of cane with three eyes buried horizontally in furrows made 1.50 m. and 2 m. apart ; the cuttings are placed 1 m. apart in the furrow.

The cane is cut in winter. It ripens with the first cold and dry weather. In summer the rainy season and in winter dry weather are the most favourable conditions for its cultivation in the Island.

Largely owing to the strong impetus given by the Experimental Agricultural Station of Santiago de las Vegas, the sugar industry makes ever increasing progress.

Tractors and the most suitable machinery for reducing the cost of production and improving the quality have been introduced.

At the State Agricultural Station itself many new varieties of sugar cane have been produced ; they have been obtained from seed, i e., sexually, and even by hybridisation.

In the western provinces of the Island, where the soil is partly exhausted, fertilisers are used. Their use is very widespread in the Island of Cuba giving the most up to date scientific development to the agriculture of the country. Close to the sugar factories there are large establishments that prepare compound fertilisers, which are then supplied, on credit, to the growers (*colonos*) depending on the factory itself who agree to pay the amount only after the harvest.

In everything relating to the growing of the cane and to the sugar industry — chemistry and technology of manufacture, agricultural mechanics applied to tilling the ground and plant breeding — the measures taken by the Government, especially during the recent world war, show an extraordinary eagerness to realise the maximum production.

The production of sugar cane was valued at $800 per acre for the past year.

Tobacco. — Next in importance to sugar cane comes tobacco, which continues to justfy its reputation as the finest tobacco in the world. Tobacco is planted, grows and is gathered in 90 days. Cuba is always in advance of other countries regarding the growth, study and treatment of the diseases of this plant, the chemical processes and methods of industrial elaboration which are used to prepare it for the market.

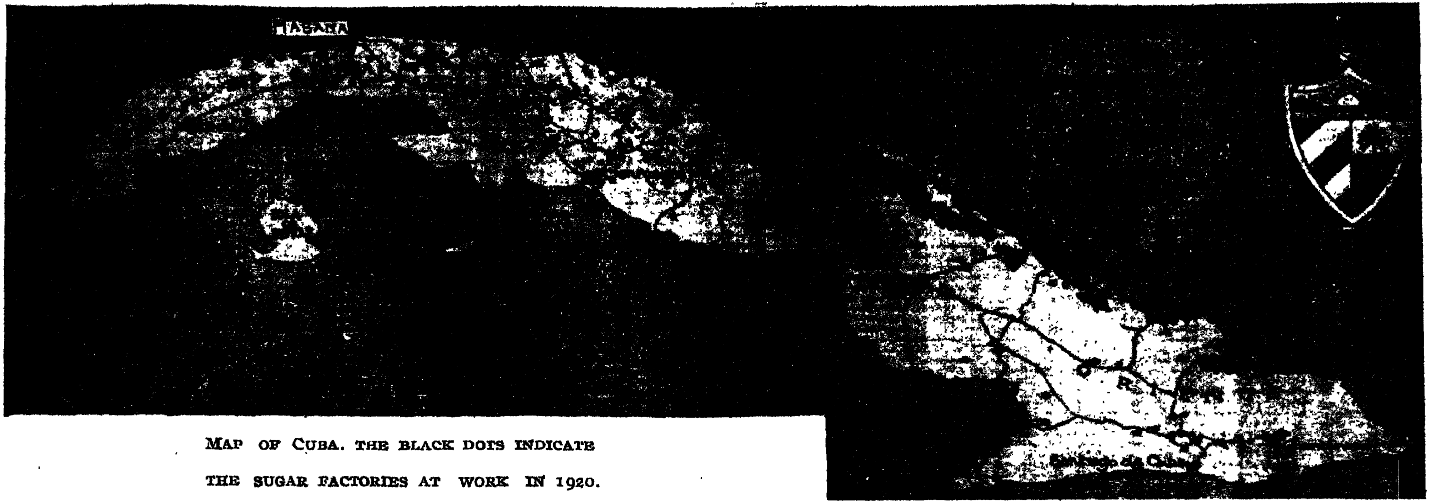
Owing to the marked specialisation of the cultivation of these two plants (sugar and tobacco) which absorb almost all the agricultural energy of the Island, the world war might have caused serious consequences to the economy of the country and in the first place have increased the difficulties of importing from abroad goods of prime necessity. But the Minister of Agriculture of the Republic managed by an active propaganda, to minimise the disadvantages accompanying the growth of a single industrial crop, and favoured by all means in his power promiscuous crops by indicating technical rules for growing food crops which could be intercalated in the cane fields, especially along the paths separating the fields (*guardarayas*) which act as firelines and facilitate the harvesting.

Cereals. — Associating himself with the plans of General E. SANCHEZ AGRAMONTE, Minister of Agriculture, and thanks to the generous and effective cooperation of the illustrious Prof. N. STRAMPELLI, Director of the Royal Italian Station for wheat cultivation, the author was able in the spring of 1918, to obtain, for despatch to Cuba, fine selected varieties of wheat seed and one of barley, specially suited to the climate and soils of the Island. The above mentioned Agricultural Experimental Station of Santiago de las Vegas made the trials; the "Carlotta Strampelli" variety in particular has given results promising well for the future.

The result will be the eventual emancipation of the Island, so far as supplies of the most indispensable cereals from abroad are concerned. At the same time world economy will have the advantage of being relieved of Cuba as a purely passive consumer and the Island will become, in time an active factor in the balance sheet of the production of wheat.

Amongst other cereals, Cuba has long grown maize, of which in normal conditions two crops are grown each year; recently the production has even been intensified. During the war a stronger impetus was also given to the growth of hill rice with good results.

Other crops. — Among crops of minor importance "boniato" (*Ipomoea batatas*), or sweet potato, occupies a place in the first rank as food for the inhabitants: it is very commonly used and its varieties are numerous, some



MAP OF CUBA. THE BLACK DOTS INDICATE THE SUGAR FACTORIES AT WORK IN 1920.

having great nutritive value. There is also the yuca (*Manihot palmata aipi*), the tuberous roots of which, when a year old, have an exquisite flavour. The Indian bread of old time, *casabe*, was made from this tuber. Cuba also produces the common potato, and various species of bananas; one of the latter sometimes is substituted for bread.

The cultivation of citrus plants is very widespread. Oranges, according to their degree of maturity yield from $50 to $500 per acre.

Kitchen gardens can yield everywhere a revenue of about $100 to $400 per acre.

Besides the crops already named those of other tropical products, such as coconut, cocoa, coffee, yam, sorghum, etc., are not neglected in the Island.

Tractors and fertilisers. — The use of tractors and of a fertiliser very rich in phosphoric acid, bat guano, which is found in large quantities in limestone caves in the Island, were of great use to Cuban agriculture in the most critical moments of the war to make up for want of manual labour and fertilisers. Thus Cuba was able, through to its abundant production of sugar, to provide for the pressing needs of European nations during the war by supplying sugar at prices that were relatively moderate, especially if the increased cost of production at that calamitous time is considered. Consequent on the impulse given to agricultural production by the State Central Agricultural Station, at present managed on scientific lines by Dr. CALVINO, an Italian, supported by the Government of the Republic, there has been fruitful initiative in the introduction of many new plants, especially forage plants of great nutritive value for feeding cattle, caucho, etc., as well as an increasingly thorough study of the special diseases of the plants of the Island and the means best suited to their treatment.

On this last subject, I propose shortly to make a more detailed communication (1).

880 - **The Agricultural and Forestry Experimental Station of Phu-tho (Tonkin).** — GILBERT, H., in *Le Moniteur d'Indochine*, Year II, No. 67, pp. 5-8, figs. 7. Hanoi, April 10, 1920.

The Agricultural and Forestry Experimental Station of Phu-tho was created by an order dated June 21, 1918 of the High Resident at Tonkin, on the proposal of M. CHEVALIER (Head of the Permanent Mission of Agriculture and Forests of the Colonies) then charged with the Inspection of Agriculture and Forests in Indo-China and in agreement with the opinion of the Director of the Agricultural and Commercial Services of Tonkin.

Its object is to proceed with the acclimatisation and the study of all plants having an agricultural and forestry interest, notably researches relating to coffee, tea, trees producing oil, lac and paper in Tonkin, and to give practical instruction to the students of the College of Agriculture and Forestry of Indo-China (1).

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(1) See No. 955 of this *Review*.

The object to be attained being very vast, land was required served a railway or a river, both if possible, and not too far from Hanoï. M. CHEVALIER wished to make it the central Station of Tonkin and to install there the Direction of the Agricultural and Commercial Services with its various branches. The search was somewhat prolonged as large areas of uncultivated land are scarce in the central region of Tonkin.

The Administration finally chose land situated at 6 km. from Phu-tho at the junction of the Phu-tho—Phu-doan, Phu-tho—Viétri, and Phu-tho—Lemy roads. The lands are composed of tree-clad, bushy or grassy round hills intersected by low-lying rice fields or swamps. Their diversity allows all possible crops of the country to be tried; and they were selected for this reason combined with their exceptional situation near to Phu-ho and within a few hours of Hanoi.

The area appropriated to the Station is roughly 1500 ha., of which 300 are under forest, 400 under rice fields and 800 bushy round hills; the greater part of the land was already in the forest reserve.

Work was commenced on July 21, 1918. Straw huts as quarters for the workmen and the native supervisor had first to be erected, the land to be brought under cultivation had to be cleared and worked, and roads traced. At present 120 ha. are worked of which two thirds are planted, and there are 10 km. of 4 m. roads to open them up.

The first business of the author was to make a nursery for coffee plants Since 1917 M. CHEVALIER, through the Governor General, has been in correspondence with all the scientific establishments in the world, and they have sent to the Station numerous lots of seeds of coffee and later of tea. The French Colonies have contributed to this work, but Buitenzorg (Java) has sent most of the coffee seed and the Indian Tea Association. whose Experimental Station is at Cinnamara (Assam), has furnished the Assam and Ceylon tea plants. The Phu-tho Station has numerous lots of various species and varieties under acclimatisation tests, each lot comprising from 100 to 400 plants. By observing the plants during the course of their growth it will be possible to pick out those which are worth keeping. Besides the experimental plantations which cover about 5 ha. and are enlarged by the author according as the Station receivves new seeds, experiments on shading, spacing and manuring have been undertaken with acclimatised *Coffea arabica*, *excelsa* and *liberica* on about 7 ha.

In Tonkin, where the dry season is fairly long and where the heavy summer rains cause ravines and carry off the greater part of the fertilising principles of the soil, it is necessary, especially on hilly ground, to provide a remedy. Thus at the Station the growth of coffee shrubs on terraces 7 m., 4 m., and 3 m. wide has been tried. No doubt these terraces will prevent the formation of ravines, will retain the rain water and enable it to sink into the soil and preserve its humidity so that the coffee shrubs will not suffer during the dry season.

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(1) Regarding the creation of the College see *R.*, Oct 1918, No. 1068 (*Ed.*)

The work which these experiments require is done as economically as possible under the same conditions as those of a private owner so that the account may be published in a few years and will enable planters to know and to give a good direction to their work.

Regarding tea bushes, the author has endeavoured first to get together all the local varieties. The Station has the following:—

Ordinary Tonkin tea; Haigiang, sector of Than-thung tea,; Haigiang, sector of Lao-Khang tea; Wild tea of the Tiên-yên region; Wild tea with large leaves of mount Bavi; Wild tea with small leaves of mount Bavi; Wild tea of the Thanh-ba region; Cochin-China tea.

In comparison with the Indo-China teas, various Indian teas are studied at the Station, viz., varieties of Ceylon, Assam, Calcutta, etc.

The tea plantations cover 6 ha. and will be enlarged in the course of the year, for when the planters of Tonkin learn to prepare tea in a suitable way they will no doubt dispose of their crop at remunerative prices. The cultivation of tea is also receiving attention as well as that of coffee.

The trees which produce oil are known and their seeds are extracted by the natives; but up to date neither the natives nor the European planters have made them the object of regular cultivation and it is impossible to say with any certainly what the growth of these trees would bring in. With the object of throwing light on this question the author has made plantations of the following species:—

Garcinia tonkinensis	3.5	hectares
Bassia Pasquieri (Than-hoa oil tree)	2.5	»
Aleurites moluccana	3.0	»
Aleurites montana	1.5	»
Aleurites Fordii (from Quang-Tung)	2.5	»
Camellia drupifera	2.5	»
Illicium verum.	4.0	»

These experiments take a long time and cannot be conclusive for some ten years, as the trees do not produce seed before they are 5 or 6 years old.

The Station nursery is 1.5 hectares in area; all trees and shrubs of any value are collected and it is renewed each year. Besides the plantations made at the Station the plants for which come from this nursery, it has been possible to distribute to natives, European planters and for the avenues of Phu-tho, 1000 coffee plants, 3000 oil-producing trees or avenue trees and 3000 tea plants. Some experiments with annuals such as tobacco, groundnuts, flax and rice, have been commenced.

Fruit trees have also had attention; the best varieties of local and Yunnan fruit trees, such as peach, apple, pear, orange, etc. have been collected. The orchard is 3 ha. in area. The herd at present comprises 102 head of cattle and has been doubled in the course of 1920. The marshy flats which are drained to transform them into hay meadows will permit the animals to be kept in byres and the introduction of animals of foreign breeds to improve the local breeds.

From a forestry standpoint nothing has been done up to the present, but shortly it will be possible to proceed with the installation of the arboretum ; two wooded round hills of an area of 30 ha. are reserved for this purpose. The forest after being cleared of under growth will be divided by lanes which will give access to it. Each division will include one family of plants ; the well-grown trees at present standing will not be sacrificed but labelled differently so as to indicate to visitors that they are not in their logical place. By degrees by means of plantation, as many species as possible will be introduced into the arboretum, its object being to furnish material for study to the European Forest Officers commencing their career and to the students of the College.

The forest itself will be penetrated by communicating roads and divided into experimental and working felling areas. This work, carried out methodically for some ten years, will cause the Station to possess a forest property of real value.

881 - **Results of Agricultural Experiments in Iceland.** — HELGASON, E., and SIGURDSSON, S., in *Búnáðarrit* 34 *Aarg* Reykjavik; summarised in *Nordisk Fordbrugsforkning*, Part 4, pp. 146-147. Copenhagen, 1921.

Results of a series of researches undertaken at the two principal Agricultural Stations of Reykjavik and Akureyri ; they relate to: — Manurial experiments, especially with fertilisers, the growth of root crops, potatoes, forage grasses, cabbages and other kitchen garden plants, arboriculture, the raising of ornamental plants, etc.

It appears from the manurial experiments that the Icelandic soils are generally poor in nitrogenous material and in phosphoric acid, whereas they have abundance of potash ; in any case, the use of potassic fertilisers is always to be recommended with potatoes or when basin irrigation is employed.

Regarding the forage grasses and leguminous forage plants the following species are recommended:— *Poa trivialis, Poa pratensis, Festuca rubra, Phleum pratense, Alopecurus pratensis, Bromus inermis, B. arvensis, Agrostis alba, Aira cespitosa, Trifolium repens,* and *Vicia cracca.*

Trifolium pratense and *T. hybridum,* however, gave negative or partly negative results.

At the Reykjavik Station, *Phleum pratense* produced on an average, for 18 years, 4800 kg per hectare, and at Akureyri Station it also gave a good yield of hay. The *Poas* on average for several years gave a little over 4000 kg. per ha.

On moraine soils that are sufficiently warm and moist, *Alopecurus* stands first of the forage grasses ; it was surpassed on one occasion by *Bromus arvensis,* which yielded 9600 kg. per ha.

Oats, barley, and winter rye also gave a good yield ; and it would be erroneous to say that the growth of rye for grain has been completely given up. Among the varieties which have given the best results the authors mention :— for oats, Grenaa and Mesdag ; for barley, Early Svalöf, 6-row barley and Bjorneby barley.

The best kinds of forage root crops yielded an average of 30 000 kg. per ha. ; White Globe, Fynsk Bortf, Grey Stone, Red American turnip are in the first rank.

Among the turnip cabbages may be mentioned Bangholm, Troudpjem and Icelandic ; the latter has given the heaviest crops (it is a Bangholm acclimatised since the time of the " Landfysicus " [Land doctor] SCHIERBECKS).

In the course of researches undertaken at Reykjavik, 100 varieties of potatoes were investigated ; the 10 following gave the best results :— Harbinger, Remarkable, Beauty of Hedbom, Agnelli, Early Goldstream, Dr. v. Eckenbrecker, Prof. Dr, Orth, Bodopotet (Bodo potato) Aeggeblomme and Wonder of the World.

The following, in round figures are data relating to the best varieties for the decennial period 1904-1913, at Akureyri Station :—

	Yield per hectare	Percentage of starch
Mossrose	15 650 kg	8.9 %
Helgu hamms (Icelandic)	15 600	10.6
Akueyrar (Icelandic)	15 200	10.8
Prof. Maercker	14 800	9.2
Bodopotet	14 500	9.9

882 - **Organisation and Scope of the Department of Agriculture, Dominion of Canada.** — *The Agricultural Gazette of Canada*, Vol. 81, No. 1, pp. 7-13. Ottawa, Jan.-Feb. 1921.

The following is a statement in summarised form of the organisation of the Department of Agriculture for Canada and of the work performed by the Department.

The Department of Agriculture is divided into a number of branches, each of which takes charge of certain activities or administers certain legislation pertaining to one particular line of agricultural industry The branches of the department are as follows :

Administrative Branch
Experimental Farms Branch
Health of Animals Branch
Live Stock Branch
Dairy and Cold Storage Branch
Seed Branch.
Entomological Branch
Fruit Branch
International Institute of Agriculture
Publication Branch
Agricultural Instruction Act Branch.

The various lines of effort of each branch are given very briefly below.

ADMINISTRATIVE BRANCH. — The Administrative Branch as its name implies, has to do with the administration of the whole Department of Agriculture. The major divisions are the Minister's office, the Deputy

Minister's office, the Accountant's office, where all financial matters in connection with the department are attended to, and the office of the Translator. The Translator's office is responsible for the translation into French of all departmental publications, which are usually written in the English language, and also for the writing of French correspondence for the Administrative Branch when necessary.

EXPERIMENTAL FARMS BRANCH. — This branch is the largest of all the branches of the Federal Department of Agriculture, and is the one which probably comes more closely in touch with the farmers of the country than do any of the others. The experimental Farms system covers a wide field, and gives its service to a wide territory, as the branch Experimental Farms are scattered all over the country, from the Atlantic to the Pacific and from the international boundary line to the Yukon. The centre of the system is the Central Experimental Farm at Ottawa, and there are 20 branch experimental farms and stations at present in operation, located at the following points :

Charlottetown, P. E. I., Kentville, N. S., Nappan, N. S., Fredericton N. B., Ste. Anne de la Pocatière, Que., Cap Rouge, Que., Lennoxville, Que., La Ferme, Que., Kapuskasing, Ont., Morden, Man , Brandon, Man., Indian Head., Sask., Rosthern, Sask., Scott, Sask., Lethbride, Alta., Lacombe, Alta., Summerland, B. C., Agassiz, B. C., Invermere B. C., Sidney, B. C.

Besides the Experimental Farms proper, a number of Experimental Substations are located in the thinly settled districts of northern Alberta and the Northwest Territories where experimental work on a smaller scale is carried on. These Sub-stations are located at Beaverlodge, Alta., Fort Vermilion. Alta., Swede Creek, Y. T., Dawson, Y. T., Salmon Arm, B. C., while experimental work is also carried on for the Experimental Farms Branch at some of the settlements in the Northwest Territories, namely Fort Smith, Fort Resolution and Fort Providence.

Connected whith the Experimental Farms system are two Tobacco Stations, at Farnham, Que., and Harrow, Ont. These Stations are established in a country which has proved itself suitable for tobacco production and their chief line of operation is in connection with tobacco production.

In order to bring the work of the Experimental Farms more closely to the attention of farmers in some of the newer provinces, as well as the older ones, a system of Illustration Stations has now been established. Some 80 of these stations have been established in the provinces of Alberta, Saskatchewan Quebec, New Brunswick, and Nova Scotia, and their influence has already been felt in the surrounding country.

As stated above, the work of the Experimental Farms system is directed from Ottawa, where the work is divided into the following subdivisions. each under the charge of a Chief.

Horticulture
Cereals
Animal Husbandry
Field Husbandry
Chemistry
Poultry
Forage Plants
Botany
Bees
Tobacco
Illustration Stations
Fibre
Extension and Publicity.

As is indicated by its name, the Experimental Farms Branch is mainly occupied in conducting experimental and research work in connection with agriculture along the various lines indicated by the names of the divisions mentioned in the preceding paragraph.

These lines cover practically all the field of practical agriculture, and while each farm perhaps does not carry on work in all these lines, an attempt is made to make each Experimental Farm of maximum benefit to the district which it serves.

The results obtained from experimental work carried on at the Farms are given to the public through the media of press articles, publications, lectures, and addresses, exhibits at agricultural fairs, as well as by direct illustration and demonstration on the Experimental Farms themselves, and at the Illustration Stations, which endeavour to illustrate the methods that have been found to be most suitable on the Experimental Farms proper.

In addition to the experimental work, this branch also has charge of the administration of that section of the Destructive Insect and Pest Act which deals with plant diseases. For the past few years potato inspection has been carried on, and a great deal of investigation into black-rust of wheat and white pine blister rust Plant pathological laboratories have been established at Charlottetown, P. E. I., Fredericton, N. B., St. Catharines, Ont., Winnipeg, Man., Brandon, Man., Indian Head, Sask., and Sakatoon, Sask., as well as the central laboratory at Ottawa, and these laboratories serve as centres for the work of the administration of this Act, as well as for research work into plant diseases.

HEALTH OF ANIMALS BRANCH. — The activities of this branch take, in general, the direction of maintaining the health of the live stock population of the country at the highest possible standard, of safe-guarding the consumers by insuring a supply of wholesome and properly inspected meat, meat products and canned goods, and of research work in animal diseases.

The Health of Animals Branch is divided into three divisions, viz: Animal Contagious Diseases Division, which administers the Animal Contagious Diseases Act. Meat and Canned Foods Division, which administers the Meat and Canned Foods Act; Pathological Division, which conducts research work into diseases of live stock.

A large staff of veterinary inspectors is maintained by the Animal Contagious Diseases Division at ports of entry, as well as other inland points in this country. Their duties consist of the inspection of animals entering Canada, and placing such animals in quarantine if found necessary. There are 85 quarantine stations located at various ports. These inspectors also investigate and enforce control measures for outbreaks of contagious disease of live stock as they occur. A great deal of work has been done during the past few years towards the suppression of hog cholera, and under the present regulations garbage feeders are licensed and their premises periodically inspected, and quarantined if any trace of disease is found. The Animal Contagious Diseases Act also provides for the superintending of the disinfecting and cleaning of stockyards and railway cars used in the transportation of live stock. Regulations have also been put into operation whereby municipalities may obtain inspection for dairy cattle producing milk for sale in the municipality, and last year a commencement was made towards putting into operation the Accredited Herd System which has proved so successful in the United States. Under this system, owners of pure-bred herds can obtain inspection for tuberculosis, and when their herds have been proved to be free from the disease they are placed in the Accredited List and enjoy certain privileges as to export to the United States without further inspection.

The Meat and Canned Foods Division also maintains a large staff of veterinary inspectors and lay inspectors, whose duty it is to examine animals before they are slaughtered in the abattoirs, and also to examine the meat and meat products from these animals before they can be offered for sale for human consumption. These veterinary inspectors are stationed at all the large packing plants throughout the country, and this division also inspects all meat products coming into inspected plants from foreign countries. Another phase of this work is the supervision and inspection of canning factories, jam factories, evaporated milk factories and condensed milk plants doing business in Canada; the testing and reporting on samples of imported and domestic canned fruits and vegetables as well as milk, while just recently new regulations provide for the approval of this Division being obtained as to labels used on canned fruits, vegetables, and milk manufactured and offered for sale in this country.

The pathological Division maintains a Biological Laboratory at Ottawa, a Research Station at Hull, Que., and field laboratories at Agassiz, B. C, and Lethbridge, Alta. At these laboratories supplies of mallein, tuberculin and blackleg vaccine are prepared and tested and these are sold to applicants at cost. A great deal of research work has already been carried on, and is continually being carried on with various live stock diseases such as dourine, contagious abortion, chicken disease, bracken poisoning, while one officer of this division is stationed at Charlottetown, P. E. I., where he is conducting an investigation in connection with the nutrition of black foxes.

LIVE STOCK BRANCH. — The activities of this branch are in general directed towards the improvement and development of the live stock industry by the encouragement of the production of better live stock, and by improving marketing facilities. This work, while carried on under direction from Ottawa, is performed mainly in the producing and marketing districts where officers are stationed to help the producer and the shipper. This branch also administers the Live Stock and Live Stock Products Act.

The chief divisions of this branch are:—

Horse Division, Cattle Division, Sheep and Goat Division, Markets Division, Poultry Division.

The Horse Division administers the policy with reference to Federal aid to horse-breeding associations. Up to a few years ago the department owned a number of pure-bred stallions which were loaned for breeding purposes to farmers' organisations throughout the country. This policy has in the past few years been considerably modified, and the department's holdings of stallions materially decreased. At the present time it pays a grant to farmers' associations using a stallion that has been approved by the inspectors of the Horse Division. This division also makes arrangements for providing live stock judges for agricultural fairs which have received the Government grant, and investigates and gives advice upon transportation matters as affecting live stock.

The Cattle Division administers the policy with respect to the breeding of better beef and dairy cattle. Pure-bred bulls are loaned to farmers' organisations and dairy cows are tested for record of performance.

This division also has charge of the administration of the Freed Freight and Car Lot Policies which give assistance to farmers and others in taking back fron marketing centres animals brought there for slaughter but which are found by the officers to be suitable for breeding or finishing purposes.

The Sheep and Goat Division loans pure-bred rams and boars to farmers' associations under the Distribution Policy, and also supervises the grading of wool and the encouragement of its co-operative marketing by farmers' organisations. A financial grant is made by this division to farmers using pure-bred rams for the first time, while attention is also given to the organisation of ram clubs and sheep-breeding centres. A report is sent out each week dealing with the wool market, and exhibition material in connection with the sheep, goat and swine industries is prepared and shown during the season.

The Poultry Division administers the Live Stock and Live Stock Products Act as it refers to eggs, and provides for export. This division also encourages the co-operative marketing of eggs and poultry, publishes a daily and weekly egg and poultry market report, and gives advice on the transportation, packing and marketing of eggs and poultry. A record of performance for poultry has recently been inaugurated, and inspectors have been appointed to carry on the necessary work in connection therewith.

The Markets Division administers the Live Stock and Live Stock Products Act as it refers to stockyards and live stock exchanges. The part of this division located in Ottawa has largely to do with the preparation and publishing of daily, weekly and monthly market reports dealing with the marketing of live stock. Stockyard agents are stationed in the stockyards at Edmonton, Calgary, Prince Albert, Winnipeg, Toronto and Montreal to obtain marketing information, and assist farmers and live stock shippers. These officers also assist the Cattle Division in the operation of the Free Freight and Car Lot Policies.

Under the Live Stock and Live Stock Products Act the department examines all the by-laws, constitutions, etc. of live stock exchange operating in stockyards under their supervision.

Dairy and cold storage branch. — The Dairy and Cold Storage Branch, as its name implies, has to do with the dairy industry of this country, and also in a small measure with cold storage warehouses. It administers the Dairy Industry Act, the Oleomargarine Act, and the Cold Storage Act.

The chief divisions are the Dairy and Cold Storage Division and the Markets Division.

The Dairy and Cold Storage Division operates a Dairy Station at Finch, Ont., and a Pre-cooling Cold Storage Warehouse at Grimsby, Ont Experiments and investigations into the manufacture of butter and cheese are carried on, and during the past year a Dominion Educational Butter Scoring Contest has been in operation, involving the inspection and rating of samples of butter from all over the country. In order to encourage the farmer to keep only the best producing cows, officers of this division organise and carry on cow-testing work in the various provinces, while last year a commencement was made in the grading of butter offered for export at the port of Montreal. Under the Cold Storage Warehouse Act, the department pays a certain subsidy towards the erection of cold storage warehouses used for public cold storage, and the work in connection with the payment of these subsidies is under the control of this division. Investigations are carried on in connection with the shipment of fruits, dairy products and eggs, in refrigerator cars.

The Markets Division arranges for refrigerator car service for butter and cheese shipments operated by railways under agreement with the Department. Its cargo inspectors also inspect and supervise the loading at Canadian and the unloading at British ports of all shipments of perishable products. Thermographs are placed in all vessels carrying such products and the records so obtained are blue printed and distributed to shippers.

A weekly dairy produce market report and monthly news letter are published by this division, which also inspects butter under the Dairy Industry Act, and administers the Oleomargarine Act.

SEED BRANCH. — The Seed Branch works along the lines of the encouragement of the use of better and purer seed and the production of good seed. During the war years it also had charge of the work of insuring a proper supply of good seed for districts in Canada where there was an apparent shortage. This branch administers the Seed Control Act, and at the last session of Parliament the administration of the Commercial Feeding Stuffs Act was also placed under the charge of this branch.

There are four divisions in the Seed Branch namely:—

Seed Testing Division
Seed Inspection Division
Seed Markets Division
Seed Purchasing Commission.

The Seed Testing Division maintains and operates Government Seed Laboratories at Ottawa, Winnipeg and Calgary, where purity analyses and germination tests of seed samples for farmers, seed merchants, and institutions are carried on. Official samples taken by customs officers from seed importations, by seed inspectors under the Seed Control Act and for special investigations are also tested at these laboratories. A great deal of investigational and research work with seeds has been carried out during the past few years, and some valuable work connected with the micro-analytical tests of feeding-stuffs has also been brought to a favourable conclusion.

The Seed Inspection Division enforces the Seed Control Act. The inspectors connected with this division inspect seed grain and fibre flaxseed received into, and shipped from Government elevators or other warehouses by the seed Purchasing Commission, or other dealers. Certain importation regulations are applied, and general quality standards for the various grades of clover and grass seeds have also been fixed. Samples submitted to the seed laboratories for test are graded and reported on by this division.

The Seed Markets Division compiles and issues semi-monthly seed market reports, and prepares and distributes lists of reliable seed importers in other parts of the Empire and foreign countries. It also supervises the administration of the subventions paid by the Seed Branch to the various provinces in connection with seed fairs and field crop competitions. During the war years this division, in collaboration with the Division of Forage Plants of the Experimental Farms Branch, also arranged for the production of a large quantity of field root seed of which at that time it was anticipated there would be a serious shortage. Advertising and other means are resorted to in order to bring about the extension of markets for Canadian seed.

The Seed Purchasing Commission has now been in operation for some four years. It was originally established as a war measure in order to insure a supply of good seed for farmers in certain areas which had been devasted by drought or other causes, and has been in operation since that time. This Commission purchases, stores, cleans and distributes at cost price inspected seed of good quality to those districts where there is a seed shortage. It has already done a business of over three million dollars per year.

The outside work of the Seed Branch is carried on by a field staff of inspectors. For the purposes of administration the Dominion is divided into six districts, each of which has a district seed inspector in charge. The officers in these districts are occupied with seed inspection, inspecting field crops, obtaining market information, judging seed and addressing meetings.

It is anticipated that the new Commercial Feeding Stuffs Act will be put into operation early in the coming year, and this will of course necessitate a large increase in the activities of the Seed Branch.

ENTOMOLOGICAL BRANCH. — The Entomological Branch occupies itself with studies of means of control for injurious insects affecting all agricultural products. It also administers that part of the Destructive Insect and Pest Act which has reference to insect diseases. For purposes of administration the branch has four divisions:

The Division of Field Crop and Garden Insects conducts life-history studies and studies methods of control of insects injurious to field and garden crops. Outbreaks of injurious insects are investigated, and control measures organised. Specimens are identified, and some work is also carried on with investigations in reference to insects in green-houses.

The Division of Forest Insects investigates outbreaks and organises methods of control for insects affecting trees. Forest sample plot areas have been established in various districts so that the study of these insects may be facilitated.

The Division of Foreign Pests Suppression enforces the Destructive Insect and Pest Act as it refers to insects. For this purpose fumigation stations are established at a number of points and all nursery stock imported is inspected and fumigated at these stations. Whenever necessary, quarantines and embargoes are laid against foreign and native insect pests, and enforced by this division. The Division also conducts scouting work in connection with outbreaks of injurious insects.

The Division of Systematic Entomology has charge of the National Collection of Insects. This division does most of the identification work of the branch, and is also occupied in mounting and preparing material for addition to the National Collection.

The Entomological Branch also conducts investigations into insects affecting fruit, insecticides, the colonisation, liberation and recovery of parasites of various insects, as well as orchard spraying and potato spraying experiments.

The field work of this branch is conducted from 10 entomological field laboratories stationed in various parts of the country. Each of these is in charge of a competent entomologist, and from these field laboratories local insect conditions are studied.

FRUIT BRANCH. — The Fruit Branch administers the Inspection and Sales Act as it affects fruit, fruit packages and potatoes. Its work also consists of the general encouragement of the fruit industry, especially the marketing of fruit. Fruit and vegetable crop reports are published at periodical intervals and the officers of the branch assist producers and dealers in buying and selling their fruit. The fruit inspectors also address meetings of fruit growers, and give demonstrations of the proper methods of picking, grading and packing fruit. Special transportation officers are employed to give assistance and advice to shippers as to the proper routing, etc., of fruit shipments. Complaints of improper shipments of fruit are investigated, and improved methods of distribution studied. Matters connected with fruit transportation generally are discussed with railway, express and steamship officials with a view to devising means for improved methods in this regard.

PUBLICATIONS BRANCH. — The distribution of the numerous publications issued from time to time by the Department of Agriculture is carried on by the Publications Branch. Most of the Divisions publish from time to time circulars, bulletins, pamphlets, etc., and the Publications Branch maintains mailing lists and sees that all persons on these mailing lists receive the publications which they desire. This branch also has charge of the publication of the official departmental magazine, *The Agricultural Gazette*, and of other publicity material.

INTERNATIONAL INSTITUTE BRANCH. — The International Institute of Agriculture serves as the connecting link between the Canadian Department of Agriculture and the International Institute of Agriculture at Rome.

This branch obtains and publishes through the Press, and through *The Agricultural Gazette* information on matters pertaining to world agriculture which it receives through the central offices of the Institute.

It also provides the Institute with information with reference to Canadian agriculture, and the Institute Commissioner represents the Canadian Department on the International Institute. The departmental library is also under the control of this branch.

AGRICULTURAL INSTRUCTION ACT BRANCH. — Under the Agricultural Instruction Act the sum of $1 100 000 annually for a period of twenty years was appropriated to assist the provinces in agricultural instruction work.

This branch administers this Act, and makes the necessary grants to the various provinces for the purpose of providing agricultural instruction and demonstration, and agricultural education in colleges, agricultural schools, high schools and elementary schools.

883 - **The International Congress for the Control of Seeds at Copenhagen, Denmark, June 6-11, 1921.** — PETERSEN K. (Director of the State Institute for the Control of seeds), *Official communication of the Danish Government*. Copenhagen, July 4, 1921.

This Congress met at Copenhagen from June 6 to 11 last. The very best relations existed among the delegates from the beginning to the end of the Congress, which was very successful. The Congress comprised 30 delegates of the 17 following States:— Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Jugoslavia, Norway, Poland, Rumania, Switzerland, Sweden and Czecho-slovakia.

On the proposal of Sir L. WEAVER, of the British Ministry of Agriculture, and of M. INSULANDER, Director General at the Swedish Administration of Agriculture, the two Danish delegates, the presidents of the Commission for the control of seeds, Prof. W. JOHANNSEN and Director K. DORPH-PETERSEN were unanimously elected to the Presidency of the Congress.

Important detailed discussions on various subjects were followed with the greatest interest.

A proposition, put forward by Sir L. WEAVER, to form an *Association of the European Institutions for the control of seeds* and to appoint a Committee of control to carry out common work settled by the Congress, was adopted unanimously by the representatives of the States represented.

The following delegates were elected members of this Committtee:— K. DORPH-PETERSEN (Denmark), F. F. BRUIJNING (Holland) and A. VOLKART (Switzerland), all three Directors in their respective countries of State Institutes for the control of seeds. A. VOLKART was charged in addition to direct and set going comparative analyses with the object of finding out the places of origin of the seed of red clover (*Trifolium pratense*) and of lucerne (*Medicago sativa*). A Commission was also appointed, composed of Councillor of State von DEGEN (Budapest), Prof. VOIGT (Hamburg), Prof. BUSSARD (Paris), Director VITEK (Prague), and Director ENESCO (Bucharest). This Commission was given the task of making the fullest researches regarding the presence of the seed of the parasitic plant dodder (*Cuscuta* sp) and to seek means of controlling it.

Besides the meeting of the Congress, the delegates and guests met at an official dinner on the invitation of the Minister of Agriculture, who was present. In a series of speeches emphasis was given to the opportuneness of the Congress and its great success. An excursion to the State fields for the control of seeds, to the Museum of Agriculture and to the old farms of Lyndgby was followed by an informal gathering at the Hotel des Bains at Skodsborg.

On June 12, after the close of the Congress an excursion was made to the State Experimental Station at Tystoft, where LINDHARD, the Head of the experiments, demonstrated the work of plant improvement. An invitation from the British Government, transmitted by Sir WEAVER, to hold the next Congress in England in 1924 was unanimously accepted.

Prof. VOIGT, Sir L. WEAVER, Prof. BUSSARD and Director General INSULANDER at the close of the Congress expressed in very warm terms their thanks for such interesting, instructive and pleasant meetings. The Congress was agreed on the importance of teaching and carrying out the analysis of seeds. All were agreed in expressing the wish that the directing staff might have the opportunity of working for a certain time in the more important institutions for the control of seeds in foreign countries.

One of the Divisional Heads and one of the Assistants of the Office of Seed Control in London (which is to be transferred this autumn to a large new building at Cambridge) have worked during June in the State Institute for the control of seeds at Copenhagen in order to learn the method employed in Denmark for the examination of the purity of grass seeds, a method which is to be employed in Great Britain as from August of this year.

CROPS AND CULTIVATION

884 - **Effect of Altitude on the Appearance of Different Phases of Growth.**— PFAFF, W , in the *Phänologische Mitteilungen*, Year 37, No 26, pp 31-38, Darmstadt, 1920,

Results of a detailed study on the effect of altitude on phenoscopic phenomena.

The materials used in these researches were the phenological data collected during 3 years, simultaneously, and with absolutely uniform methods at Bozen-Gries and at Ober-Bozen, two localities which lend themselves very well to the object of the research. In fact, except for the difference of altitude (about 920 m), all the other conditions are practically uniform. The distance as the crow flies between the two points is only 5 km. ; the geographical constants are therefore practically identical; the soil is the same, for porphyritic formations from which the vegetable soils are derived by disintegration and washing, are found over the whole of this district; the two localities are situated on slopes, facing south, and are protected on the north by ranges of mountains; the exposure to wind is therefore the same for both. The rainfall is also distributed in a similar manner at the two stations, as indicated in the following Table, where the monthly rainfall is given as a percentage of the total annual rainfall.

	Jan.	Feb.	March	April	May	July	Juli	Aug.	Sept.	Oct.	Nov.	Dec.
Bozen.	3	3	6	8	10	11	13	13	10	11	7	5
Ober-Bozen . . .	5	3	6	7	12	11	14	12	10	10	7	3

On account of this uniformity of conditions it may be admitted that each of the stages of growth should be influenced by factors whose intensity and character vary precisely with the altitude.

These factors are:— 1) Temperature; 2) length of time the snow lies on the ground; the distribution and intensity of frosts; 3) the duration of the period of vegetation; 4) the length of the day, light, and insolation.

TEMPERATURE. — The Table of monthly and annual means in degrees centigrade is as follows.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Bozen . . .	0.0	3.0	7.5	12.7	16.6	20.4	22.5	21.5	18.0	12.2	5,5	0.9	**11.7**
Ober-Bozen	—2.7	—1.1	1.1	5.3	8.9	13.1	15.3	14.4	12.0	7.0	1,7	—1.5	**6.1**

The difference between the annual means is thus 5.6° C.; the smallest difference, 3.10 C., is found during the winter months, December-February; the greatest differences are found in spring (March-May) and in summer (June-August, 7.2°).

SNOW AND FROSTS. — At Bozen snow covers the ground only temporarily and interruptedly; on the other hand at Ober-Bozen the soil is covered with a layer of snow which is often very thick during at least 4 months.

At Bozen the mean daily temperature is below zero for 5 days in the year only (January 10-15), while at Ober-Bozen the period of frosts is 96 days (November 26 to March 2).

DURATION OF THE PERIOD OF VEGETATION. — During this period there is a difference of about 2 months in favour of Bozen. As far as these three factors are concerned, of which the two last are closely correlated with the first, namely with the temperature, the conditions at Ober-Bozen are much less favourable to the growth of plants than those of Bozen.

LENGTH OF THE DAY: INSOLATION, LIGHT. — At Bozen and Gries about 25 % of the sky is hidden by the outline of the mountains; at Ober-Bozen hardly 10 %. In this last locality there is therefore at least an hour more sunlight each day. For the same reason the light is also more feeble, as well as the intensity of the sunlight, because of the atmospheric dust which collects over the valleys.

Let us now inquire into the phenological data:—

I. — BEFORE SPRING ("Vorfrühling"). — The commencement of flowering of *Corylus Avellana* and *Tussilago Farfara* is considered as the sign of the beginning of this season. These plants flower on an average 38 ½ days earlier at Bozen than at Ober-Bozen.

II. — SPRING (*first half*) ("Erstfrühling"). — The average time of the appearance of the leaves of *Aesculus Hippocastanus, Betula verrucosa, Betula alba, Tilia parvifolia, Quercus pedunculata*, and of the commencement of flowering of *Acer platanoides, Prunus spinosa, Ribes rubrum, Betula verrucosa, Prunus avium, Pyrus communis, Prunus cerasus* and *Pyrus Malus* have been adopted as data indicating the beginning of this season (see the following Table).

Commencement of the first half of Spring.

	1916–1918 Bozen	1916–1918 Ober-Bozen	1916–1918 Difference relative to Bozen	
Aesculus Hippocastanus, **B O**	29 III	8 V	+ 40 (1)	Commencement of the first half of spring at Bozen 37 days earlier.
Acer platanoides, **b**	1 IV	7 V	+ 35 (2)	
Prunus spinosa, **b**	3 IV	9 V	+ 36 (3)	
Betula verrucosa, **B O**	1 IV	9 V	+ 38 (4)	
Betula alba, **B O**	—	—	—	
Ribes rubrum, **b**	2 IV	12 V	+ 40 (5)	
Betula verrucosa, **b**	3 IV	6 V	+ 33 (6)	
Prunus avium, **b**	4 IV	11 V	+ 37 (7)	
Pyrus communis, **b**	5 IV	14 V	+ 39 (8)	
Tilia parvifolia, **B O**	8 IV	18 V	+ 40 (9)	
Quercus pedunculata, **B O**	6 IV	—	—	
Acer platanoides, **B O**	9 IV	15 V	+ 36 (10)	
Prunus Cerasus, **b**	9 IV	—	—	
Pyrus Malus, **b**	12 IV	18 V	+ 36 (11)	
			410 : 11 = 37 (see following column)	

B O = in leaf; **b** = in flower; I-XII = January-December.

The difference in days is calculated for each of the phenoscopic data relating to Bozen and Ober-Bozen; the differences are then added and the total divided by the number of phenological values considered. The quotient represents the difference in days between the commencement of the first half of spring at Bozen and Ober-Bozen.

III. — SPRING (*second half*) ("Vollfrühling"). — The difference between the two localities is 31 days, as regards the foliation of *Fagus sylvatica,* and the flowering of the following species: — *Syringa vulgaris, Aesculus Hippocastanus, Lonicera tatarica, Berberis vulgaris, Crataegus monogyna, Crataegus Oxyacantha, Cytisus Laburnum, Sorbus Aucuparia, Euonymus europaea, Sambucus nigra, Robinia Pseudacacia, Cornus sanguinea,* and *Symphoricarpus rae.*

IV. — EARLY SUMMER ("Frühsommer"). — There is a difference of 44 days if the flowering of *Ligustrum vulgare, Tilia grandifolia, Tilia parvifolia* and the commencement of the ripening of fruits of the following plants:— *Ribes rubrum, Lonicera tatarica, Lonicera xylosteum, Symphoricarpus racemosus,* and *Sorbus Aucuparia* are regarded as standard.

V. — FULL SUMMER ("Hochsommer") begins at Bozen 45 days before Ober-Bozen in correspondence with the ripening of the fruits of *Viburnum Lantana, Sambucus nigra* and *Cornus sanguinea.*

VI. — EARLY AUTUMN ("Frühherbst"). — The difference is 21 days based on the ripening of *Ligustrum vulgare* and *Aesculus Hippocastanus.*

In the cases investigated so far the season commences much earlier at Bozen.

VII. — LATE AUTUMN ("Spätherbst"). — To mark the commencement of this phenological season the moment is taken when the leaves turn and fade. This phenomenon takes place first at Ober-Bozen, so that the seventh season, differing from those preceeding, commences first at Ober-Bozen, with a difference of 18 days, if reference is made to the following plants:— *Acer platanoides, Tilia parvifolia, Betula sylvatica,* and *Quercus pedunculata.*

According to these data and with reference to the altitude, it is reasonable to deduce that: — Per 100 m. altitude there is a delay of 4.19 days for the period just before spring; 4.08 for the first half and 3.91 for the second half of spring; 4.78 for early summer and 4.89 for full summer; 2.34 for early autumn. On the other hand, the turning of the leaves takes place first in the mountains, where instead of a delay, there is an advance of 2.06 days per 100 m.

These results agree with those already obtained by the authors and by FRITSCH, DRUDE, and HOFFMANN.

885 - **Influence of Periods of Drought on the Growth of Plants.**— PFEIFFER, T., RIPPEL A., and C. PFOTENHAUER, in *Die landwirtschaftlichen Versuchs-Stationen,* Vol. XCVI Parts V and VI, pp. 353-363. Berlin, 1920.

HELLRIEGEL, WOLLNY, PFEIFFER, with BLANCK and FLÜGEL have already noted that intercalated waterings, when water is lacking, are harmful to the growth of plants, and even a large quantity of water after a period of drought is not sufficient to repair the injury which the plant has suffered so that, especially for spring crops, an average frequency of watering is much more suitable.

E. GAIN has observed, however, that a certain quantity of water applied after a slight drought gives better results than permanent moisture even when optimum; the extreme case of injury caused by permanent moisture and a distinct advantage from interrupted waterings even occurred with the thorn-apple.

The authors have therefore considered it desirable to take up the question again by making pot experiments with lupins and spurrey as xerophilous plants, and with barley and oats as hydrophilous plants; these two last crops were, however, attacked by *Erisiphe graminis*. One series was kept at a constant humidity (60 % of the capacity of water) by replacing every day the water evaporated; the other was left in suspense up to a certain degree of humidity (30 % of the capacity of water), then a quantity of water equal to that which had been applied in the meanwhile to the first series in several waterings was applied during 26 periods. The yields in dry matter obtained were as follows: —

	Constant humidity gm.	Alternate drought gm.
Lupins	35.0 ± 0.27	24.5 ± 1.21
Spurrey	28.1 ± 0.88	21.1 ± 0.81
Barley	14.6 ± 0.21	14.4 ± 0.40
Oats	32.4 ± 2.07	28.0 ± 0.59

The deduction from these results and from other observations is that, at least for the plants in the experiment, the greatest possible constant water content of the soil gives better results, or, at worst, not inferior results to those which are obtained by using the same quantity of water intermittently. A temporary dryness of the soil, not exceeding a certain limit, causes injury of various degrees to the growth of all plants, and the reason is found in their different aptitudes for adaptation to drought relatively to their greater or less power of reducing the consumption of water; spurrey and lupin, for example, require a long time to reduce the humidity of the soil from 60 to 30 % of the capacity of water, and in the light of the experimental method adopted, these plants suffer more injury if they remain exposed for a long time to drought; barley comes next and lastly oats which make the greatest demands on the moisture in the soil.

The consumption of water per gram of dry matter produced is less with alternate periods of drought, and this is all the more noticeable with plants which adapt themselves better to the conditions of humidity of the moment, by regulating evaporation.

886 - **The Carbon Dioxide of the Soil Air.** — TURPIN, H. W., in *Cornell University Agricultural Experiment Station, Memoir* 32, pp. 319-362, figs. 16, Ithaca, N. Y., April, 1920.

Carbonic acid has long been recognised as an important soil solvent, but from the data available, it is not yet clear what are the chief factors controlling the production of carbon dioxide in the soil; although it is generally considered, that a large proportion is due to the action of micro-organisms, the part played by plant-root excretions in this connection has not been determined. With a view to deciding this question, the author carried out a series of pot (the plants being grown in iron cylinders) and greenhouse experiments, a special arrangement for estimating the carbon dioxide being employed. The soil was a heavy clay loam rich in silt, and brought up to 30 % moisture content on the oven-dry basis.

It was found by these experiments, that oats increased the production of carbon dioxide in the soil. This increase became marked after the first month from the time of sowing, and increased to a maximum just before or after the plants headed; then there was a gradual decline. Millet (*Setaria italica*), behaved in much the same manner, but the production of carbon dioxide by each plant was approximately half as great, and the most marked rise in the carbon-dioxide content of the soil occurred at a later period of growth than in the case of the oats. The cropped soil, after harvest, maintained a higher percentage of carbon-dioxide than was found in the uncropped soil. This was probably due to the decomposition of the plant roots left in the ground. The correlation existing between carbon-dioxide production and transpiration would seem to confirm the theory that increased plant growth is accompanied by more intense formation of carbon-dioxide. Fluctuations in the amount present in the uncropped soil were accompanied by similar fluctuations in cropped soil only after the removal of the crop and before the plants had made much growth. There appeared to be no definite connection between the soil temperature at the time of sampling and the carbon dioxide in the cultivated soil, or that assumed to be produced by the crop (determined by subtracting the carbon-dioxide in the bare soil from that in the cropped soil). In fact, the carbon dioxide content of the former was usually high during warm weather, and low when the temperature decreased; further, very low atmospheric pressures were usually accompanied by an increase in the amount of carbon-dioxide in the uncultivated soil.

The carbon-dioxide produced presumably by the plants appeared to be independent of the initial carbon-dioxide content of the soil, which would seem to indicate that plants and soil organisms act independently in the production of this substance.

In conclusion: it may be assumed, that the plant itself and the micro-organisms present in the soil produce most of the carbon-dioxide. At the period of its most active growth, the plant produces much more carbon-dioxide than the soil organisms, and the excess carbonic acid in cropped soil is due to the respiratory activity of the plants rather than to the decay of root particles, from the crop growing on the soil at the time of analysis.

887 - **The Concentration of the Soil Solution Around the Soil Particles.**— Y J. BOUYOUCOS (Michigan Agricultural Experiment Station), in *Soil Science*, Vol XI, No. 2, pp. 131-138. Bibliography of 3 Works. Baltimore, February 1921.

On account of the supposed adsorptive property of soils, it is generally believed that the soil solution in immediate contact with the surface of the particles has a greater concentration than the remainder of the solution. This opinion has however never been confirmed, and the author indeed holds the opposite view, namely that the concentration of the solution around the soil particles is lower than elsewhere. The experimental evidence brought forward in support of this conclusion is briefly as follows:

a) The diminution of the freezing-point lowerings of soils by successive freezing and thawing; *b*) the liberation of unfree water from soils subjected to this treatment; *c*) the abnormally greater increase in the freezing-point depression of soils as the moisture content diminishes; *d*) the equality in the freezing-point lowering between the supernatant liquid and the soil which it bathes.

The first phenomenon may be explained by the fact that the soils have the power of causing a certain quantity of water to become unfree. This water may be in the soil either as capillary-adsorbed, or chemically combined, or both; it is less concentrated than the solution which freezes at the first time It is liberated from the capillaries by the process of freezing, and in this way, the freezing point is lowered, as stated in *b*. The dilatometer method also showed that the unfree water decreased with repeated freezing and thawing.

The depression of the freezing-point of soils tends to increase in a geometrical progression as the moisture content decreases in an arithmetical progression; this proves, as is said in *c*, that the concentration of the soil solution increases at the expense of the soil particles, which retain the water alone.

As regards soils bathed in the solution, they should if the generally received opinion be correct, have the power to fix a greater amount of salts than the supernatant solution, and hence would show a greater lowering of the freezing point than the latter. This has not been found to be the case (see *d*); indeed, frequently there was a depression in the freezing point of the supernatant liquid, and consequently an increase in its concentration, which points to the conclusion that the solution around, or in immediate contact with the surface of the soil particles, is less concentrated than the mass of the solution. It therefore appears very doubtful whether there really is a physical adsorption of dissolved mineral solids by soils.

A correct knowledge of this particular point is of far reaching importance for the proper understanding of both the soil solution and its utilisation by plants.

888 - **Preliminary Notes on the Microbiology of the Soil and on the Possible Existence of Invisible Organisms in it.** — Rossi, G. (Istituto di Batteriologia Agraria della R. Scuola Sup. d'Agricoltura, Portici), in the *Annali della R. Scuola Superiore di Agricoltura in Portici*, Series II, Vol. XV, Notizie per alcune serie di lavori di microbiologia in corso, I, pp. 3-7. Portici, 1920.

The microbial flora (Schizomycetes, Blastomycetes and Hyphomycetes) of the soil is very little known, not only from the standpoint of the enumeration of the species there present, but especially from that of its signification. The principal reason is the great uncertainty which surrounds the methods of research and among the various aspects of the problem due to this lack of method and of criticism, the author indicated :—

A) The uncertainty arising from the counting of the organisms of the soil, as a slight change in method entails a very great change in the numerical result.

B) The obstacles arising from the antagonism which can be exerted between number and quality during growth; in most cases the number of germs which can be developed by the soil by means of isolating cultures diluted in agar and gelatin, is inversely proportional to the quantity of the soil infusion used ; for example with $1/_{25}$ cc. of soil infusion a greater number of organisms is generally obtained than with $^1/_{10}$ cc.

C) The influence of methods employed for the isolation of the species of micro-organisms in the soil. As has been proved by the experience gained during many years by the author the investigation of the species present in the soil is related to the method of isolation employed and especially to the nutritive medium selected ; agar, gelatin, or even potatoes, however they are prepared, never give different results with *mesentericus, radiciformae, fluorescens,* coloured *cocci, Streptothrix,* moulds, etc., and the soil always contains some germs which, like *B. mycoides,* are always present and of which a small number suffices to prevent the development of all other species.

D) The insufficiency of the methods for isolating certain species ; for example, after having spent much time in isolating nitrifying bacteria it seems clear that WINOGRADSKY, MIGULA, and WARINGTON were right in affirming that their presence was absolutely accidental; often by inseminating up to 8-10 flasks of elective nutritive solutions with soil no nitrifying organisms developed in any of them.

E) The enormous difficulty of sterilising the soil absolutely ; it is well known that the autoclave and KOCH's steam stove do not sterilise soil within a reasonable time ; the same is true of direct roasting with fire and the hot air stove has still less effect. Now, given the great complexity of the chemical and physical structure of the soil, the presence in it of hydrosols which are coagulated by heat, as well as the existence of a circulating solution, which may be considered as the actual medium of the soil, where the micro-organisms act, bringing about reactions and submitting to its influence, it is clear that any sterilisation, chemical or physical, must profoundly impair the powers of so sensitive a medium and falsify the results of eventual experiments.

F) The lack of sensitiveness of certain chemical methods, which are the only methods available for observing the reactions caused by the microbes is also an obstacle. The following are two examples :— The lack of sensitiveness in the determination of nitrogen, necessary for the study of nitrogen fixers, for which so far nothing better has been discovered than KJELDAHL's method and its modifications and which only shows the quantities calculable in mgm. ; the difficulties of the research of nitric acid in the presence of large quantities of nitrous acid, for which, even qualitatively, we have nothing more sensitive than the insensitive method of LUNGE-LUVOFF.

To sum up it must be admitted that there is reason for much hesitation before the whole microbiological mechanism of certain processes of the soil are considered as known, such as those of nitrification and the fixing of nitrogen ; it does not suffice for their explanation to have succeeded in isolating from the soil germs which nitrify or fix nitrogen *in vitro*. All this throws much uncertainty on that which is known, not of the biochemical power of many micro-organisms, but rather regarding their actual value in the soil. Besides what has already been noted, it should also not be forgotten that many of the theories on the processes of the soil are founded on phenomena which have taken place and are studied with germs which are indeed isolated from the soil but which are made to act in artificial solutions which certainly cannot be compared with the circulating solution of the soil.

It is then the insufficiency of the microbial flora recognisable in the soil to explain many phenomena which are produced in it which has led the author to search for the presence of an eventual or ultra-microscopic flora, or better, invisible germs, in the soil. The method employed was a direct method, by filtering soil extracts through a CHAMBERLAND filter and by submitting the aseptic filtered liquid to the principal reactions attributed to visible germs, e. g., putrefactive (ammonia, indol, phenol), nitrifying, nitrogen fixing. As the filtered liquid contained ammonia and nitrites, indol was searched for in a nutritive liquid containing peptone, but the result was negative, while there was an abundant formation with the non-filtered extract. The sterilised filtered liquid also caused no increase of nitrites in a saline ammoniacal solution also sterilised.

According to these results the presence of invisible germs in the soil should be excluded, but this is not sufficient; it will therefore be interesting to follow the results, whatever they may be, of the experiments still in progress.

889 - **Modern Commercial Fertilisers in China.**— REISNER J. H. (Dean, College of Agriculture and Forestry, University of Nanking, Nanking, China) in *The American Fertilizer* Vol. LIV, No. 10, pp. 54-57. Philadelphia, May 7, 1921.

The most potent factor in China's maintenance of her present agricultural production is her scrupulous care in the utilisation of everything that has fertilising value. One of the most important of her fertilisers is night soil, the supply of which is cheap, the use of which is well established beyond the pale of objection so far as the Chinese are concerned, and will prove to be the keenest of competitors when commercial fertilisers enter the field. On the basis of a population of 400 000 000 people, an annual production of 1 073.3 lb. per head (data based on European sources), the total production of night soil in China would be 428 120 000 000 lb., of which it is safe to say that two-thirds, or 285 420 000 000 lb., is saved and used as fertiliser to produce crops. Taking the average of Japanese and European figures on the composition of night soil we find that the percentage of fertilising elements is as follows: Nitrogen 0.63 per cent.; phosphoric acid 0.20 per cent.; and potash 0.24 per cent. Calculating on the basis of the above figures, the amount of nitrogen, phosphoric acid and potash that would be used annually would be approximately:

	lb	$
Nitrogen	1 800 000 000	360 000 000
Phosphoric acid	570 000 000	57 000 000
Potash	685 000 000	85 000 000
Total . .	3 055 000 000	502 000 000

These gold values of the fertiliser elements are secured by using the present retail prices of approximately 20 cents per pound for nitrogen, 10 cents for phosphoric acid and 12 ½ cents for potash. These amounts only represent equivalents, but as such they are important in showing the difficulties if not impossibilities attended by the idea of substituting in part or in whole modern commercial fertilisers for night soil.

If we reduce the 428 000 000 000 lb. of night soil produced annually, and the estimated 285 000 000 000 lb. used, to Chinese weights, we would have approximately 2 149 000 000 piculs (picul = 133 pounds avoirdupois). Fresh night soil is usually sold for about six to ten chinese cents a picul, depending upon locality and demand. Taking eight cents as an average, which is admittedly too high, the value in silver would be $171 900 000 (1). This sum would be more rightly considered the money value of the night soil annually used on the basis of the commercial rates at which it is sold. It would be very difficult to determine the total money value of the night soil that was actually sold, or bartered for, but it would probably not be more than one-fourth or one-third the sum above noted, say approximately $50 000 000 Chinese currency. It is estimated that from 75 to 85 % of the Chinese population belongs to the farming classes, and if this is the case, the estimate of the percentage of total production used and entering into barter or sale is not far wrong.

From the above it will be seen that the largest part of the annual production does not enter into trade and is used where it is produced and represents no cash investment. The labor used in collecting, caring for and applying to the soil would not be considered by the farmers as having a money value. It represents clear gain so far as he is concerned and in no sense as costing anything. In other words, about $50 000 000 local currency would pay for all the night soil that is sold and bought annually, and be considered the annual investment in night soil fertilisers.

But to substitute an equivalent amount of commercial fertilisers for the total night soil consumption would require at present prices $502 000 000 gold against 50 000 000 silver currency, which is itself argument enough to prove that the modern commercial fertiliser will not for a long time dispossess night soil from the place it now holds in the maintenance of Chinese soil fertility and production of crops.

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(1) The Chinese or silver dollar of 100 cents = 72 % of Haikwan tael of about 2 s 6 d or U. S. gold $ 0 61. (*Ed.*)

It has also been pointed out that China instead of exporting vegetable meal fertilisers such as bean cake, rape seed cake, etc., should use them at home. She does use them in very large quantities, but no one knows just how large quantities of this class of fertilisers is used. In 1918, according to the Customs " Returns of Trade " and " Trade Reports," China exported over 16 000 000 piculs of bean cake, having a value of 29 882 829 Haikwan taels. The total exports of all fertilizing materials of this class was over 17 500 000 piculs, with a total value of a little less than 32 000 000 Haikwan taels. Reduced to pounds and dollars, the yearly export averaged $1.92 Chinese currency per 100 lb. Taking the average of several analyses, the chemical composition of soy bean cake gives nitrogen, 6.62 %, phosphoric acid, 2.20 % and potash, 1.80 %. Accepting the relative price for nitrogen, phosphoric acid and potash as before the war as 20,5 and 5 cents per pound respectively, we have a proportion of 4-1-1. Calculating from the above we find that the nitrogen was worth 19.4 cents Chinese per pound, phosphoric acid was worth 14.5 cents per pound and potash, 17.8 cents per pound. Comparing these figures with those found in the same way for night soil at 8 cents per picul, we have nitrogen in night soil costing 6.3 cents per pound, phosphoric acid costing 5.0 cents per pound, and potash 4.1 cents per pound. The following table will serve to bring out the contrasts :

Cost of fertilising constituents in Chinese currency on pre-war basis.

	Prices Nitrogen	(Cents per pound). Phosphoric acid	Potash
	—	—	—
In soy bean cake	19.4	14.5	17.8
In night soil	6.3	5.0	4.1
Present U. S. prices in gold	20.0	10.0	12.5

The objection might be raised on the ground that the customs value would give a higher value than local market prices. This is probably true. Soy bean cake sells in Nanking for from $1.50 to $2 Chinese currency per 100 lb. But if the figures above are changed on this basis, and on the corresponding basis that night soil sells locally at 6 cents per picul, the contrast is still more striking.

The figures given above show again, as in the case of commercial fertilisers, that the use of night soil is much cheaper than soy bean or any other kind of vegetable cake at the same price. More than that, the difference is marked and places a big handicap on bean and other cake fertilisers in coming into greater demand.

The objection is equally pertinent to both vegetable meal fertiliser and night soil that they are both « unbalanced » fertilisers, by which term is meant an undue proportion of one element to the other two. In both, the percentage of nitrogen is too great in proportion to the amount of phosphoric acid and potash, and this has a tendency to emphasise the effect of nitrogen on crops which the effects of the smaller quantities of phosphoric acid and potash cannot counterbalance. The disadvantage of an excessive quantity of nitrogen is, of course, well known, namely, that it produces vegetative growth at the expense of the reproductive parts such as seeds, fruits, etc. The above statements are in large part true for most of the organic fertilisers including farm manures, green manures, composts, etc.

Probably China's greatest need in the fertiliser line is a more abundant supply of phosphate and potash to be used in connection with those she now uses most commonly, the organic fertilisers noted above. The phosphate fertilisers she supplies to a limited extent in the form of bones. However, in 1918 China exported — the largest share going to Japan — 577 388 piculs of raw bones with a value of 1 ⅓ Chinese cents per pound. The export of raw bones should be prohibited and the bone phosphate industry encouraged. Potash is also supplied separately, for the most part in the form of grass ashes. This the Chinese use widely, though it is questionable whether they fully appreciate the care necessary for properly handling, nor the great ease with which the soluble potash leaches away. Hard wood ashes unleached carry from 0.5 to 12 % potash and constitute one of the oldest sources of potash as a fertiliser. Large deposits of both mineral phosphate and potash salts, have been reported but they have never materialised.

Considerable experimental work will have to be done in the whole matter of fertilizers in China, but it seems fairly safe to predict a big need for both phosphate and potash which the farmers will be willing to meet, when once shown they are profitable when used in connection with their present fertilisers. This will create a considerable demand, which will have to be met in some way or other, possibly importation from abroad if the supply cannot be found in China.

It would seem then that China must continue her centuries-old use of night soil to maintain the fertility of her soil, and to keep up her agricultural production; that neither modern commercial fertilisers nor vegetable meal fertilisers can compete with night soil, and that her greatest needs at present are independent supplies of potash and phosphate to use in conjunction with the organic fertilisers, upon which she mostly depends.

Finally, the export figures for China during 1919 indicate the amount of fertiliser material exported from China for this year. Attention should be called to the fact that the largest part by far of these exports, was from Manchuria — and must not be taken as indicating the condition of supply in China proper, where six-sevenths of the population lives on one-third of the area. The fact that in one year China exported over 1 500 000 tons of vegetable cake fertilisers and over 50 000 tons of bones, is impressive, to say the least.

Chinese exports of fertiliser materials in 1919.

	Piculs	Haikwan Taels
Bean cake	20 724 769	14 173 118
Peanut cake	311 231	479 490
Rape seed cake	536 613	737 650
Sesamum seed cake	308	345
Other kinds of cake	1 264 230	2 091 270
Total vegetable cakes	22 836 151	47 481 873

U. S. equivalents: 1 522 460 *tons*: 62 251 616 *gold dollars.*

	Piculs	Haikwan Tael
Bones	808 368	1 066 513

U. S. equivalents: 53 893 *tons*: 1 375 800 *gold dollars.*

What is needed now, so far as the problem of the use of commercial fertilisers in China is concerned, is a careful, scientifically-conducted series of experiments to determine to what extent the use of modern fertilisers would increase production. The China market for commercial fertilisers will always be an unknown quantity until these data are secured. In the meantime the demand for food production in China will increase, not only because of her rapidly increasing population, but because of her rapidly extending industrial development along modern lines.

890 - **The World's Synthetic Nitrogenous-Fertiliser Industry.** — I. WAESER, B., Fortschritte der anorganischen Grossindustrie während des Weltkrieges: Stikstoff und seine Verbindungen, in *Chemiker Zeitung*, Year 44, Nos. 102, 105, 106, 108, 110, 116, 122, 124, 127, 128, 129, 130, 134, 135, 4 figs., Bibliography of 589 publications. Gothen, Aug.-Nov., 1920. — II. MEINGAST, R., Die Fortschritte der elektrochemischen Industrie in den Jahren 1916-1919, *Ibid.*, Nos. 150, 153, 3 figs., Bibliography of 124 publications, Dec., 1920. — III. WICHERN, G., Bericht über die Fortschritte der Düngemittelindustrie in den Jahren 1913-1920. *Ibid.*, Nos. 10 and 16, Bibliography of 141 publications. Jan.-Feb., 1921. — IV. ESCARD, J., Utilisation industrielle de la cyanamide, in *Le phosphate et les engrais chimiques*, Year 30, pp. 110-112. Paris, April 1921.

I. PROGRESS OF THE INORGANIC CHEMICAL INDUSTRY DURING THE WAR:— NITROGEN AND ITS COMPOUNDS. — Interesting review of all the patents and methods of the modern synthetic-nitrogen industry; it contains technical, commercial and agricultural information. Only that portion which relates to nitrogenous fertilisers and agriculture are reviewed here (1). —

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(1) Nitrogenous fertilisers are at present divided into 3 classes, according to their origin:— 1) Minerals; 2) by-products of dry distillation; 3) Synthetic. The *Review* of July-Sept., 1919, No. 834, has already dealt with the processes of combination of free atmospheric nitrogen; they may at present be divided into 5 groups or principal methods:— 1) Nitric method of direct combustion in the electric arc (BIRKELAND-EYDE, SCHÖNHERR, PAULING, WIELGOLASKI processes); (2) cyanamide method (FRANK-CARO, POLZENIUS, CARLSON), (3) method of azides (SERPECK); (4) method of synthesising ammonia (HABER, CLAUDE, CASALE); (5) Cyanide method (BUCHER).

From ammonia, produced in any way, nitric acid is obtained in great quantity

During the war the requirements of explosive factories and those of agriculture on the one hand and the difficulties of sea-borne trade on the other gave an enormous development to the nitrogen industry all over the world and especially to the cyanamide industry, for the direct ammoniacal method was only employed in Germany and the other methods made relatively little progress. According to W. S. LANDIS of the American Cyanamide Co., the annual production of works using synthetic processes in the whole world has increased from 83 680 tons in 1913 to 271 170 at the beginning of 1916. The recent world-production of all nitrogenous fertilisers expressed in thousands of tons of nitrogen is summed up as follows (2): —

	1919	1918	1917	1914
(1) Chile saltpetre	520	500	372	368
(2) Ammonia by distillation	350	350	461	260
(3) Calcium cyanamide	343	265	186	28
(4) Nitrogen by the arc process	15	15	34	10
(5) HABER ammonia	109	109	114	11
6. Other synthetic processes	—	—	39	—
	1 337	**1 239**	**1 206**	**677**

As regards the productive efficiency of these fertilisers it is known from experiments made in central Europe that in 1914 the surplus due to the effect of Chilean nitrate varied between 15 and 83 %, compared with the crop without nitrate; in 1915 the surplus due to sulphate of ammonia was from 10 to 117 %.

According to GERLACH, sulphate of ammonia has a fertilising efficiency of 89 % of that of nitrates of soda and of lime and from 76-80 % of that of calcium cyanamide. According to CARO, one ton of synthetic nitrogen used as a fertiliser produces an average increased yield of 30 tons of cereals and 100 tons of potatoes. According to BUEB it would produce, in central Europe, the following surplus yields: —

For wheat	18	tons of grain plus	40	tons of straw
» barley	24	» » » »	30	» » »
» oats	24	» » » »	34	» » »
» potatoes	129	» » tubers »	40	» » leaves
» sugar beet . . .	150	» » roots »	199	» » »
» mangels	240	» » » »	75	» » »

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by catalytic oxidation (OSTWALD-BAUER, FRANK-CARO processes) and from it is obtained the greater part of the synthetic nitrates used as fertilisers. Agriculture employs $^4/_5$ of the nitrogenous compounds at present produced Cf. BOSCH, Nitrogen in economics and technology in *Zentral-Blatt fur die Kunstdunger-Industrie*, Year 25, No. 1, p. 3. Frankfort, Jan, 1921 (*Ed*)

(2) The data for 1917 are quoted from *R.* 1919, No. 834. For comparisons, see — INTERNATIONAL INSTITUTE OF AGRICULTURE, *Mouvement International des engrais et des produits chimiques utiles à l'agriculture.* (*Ed.*)

The great development of synthetic nitrogen has even led to the invention of special machines and a special mechanical construction industry. On the other hand out of 173 Chilian nitre-beds actually in existence, less than 60 were being worked in 1919 and this was as much due to the competition of synthetic nitrogen as to the lack of fuel, the difficulties of commerce and the European political and financial instability. However an *Instituto cientifico e industrial del Salitre* has recently been created in Chile with the object of studying technical improvements and of increasing the possibilities of competition by Chili saltpetre, of which, however, according to WAESER, synthetic products need not be afraid.

Numerous experiments have been made and there has been much discussion to facilitate the inoffensive application and action of synthetic nitrogenous fertilisers. Opinions differ regarding the caustic and poisonous effect of calcium cyanamide in the factories, especially on workmen who consume alcoholic beverages. To prevent injury to the country people who spread calcium cyanamide in the fields a special competition with prizes was held in Prussia in 1915, but without result. CARO affirms that the best method for giving immunity is granulation with 3 to 4 % of heavy oil, since any treatment with water or with hygroscopic salts would have the defect of causing a loss of nitrogen.

WINTERFELD mixed calcium cyanamide with dolomitic sand. NEUSS and STIEGLER add to it peat and the last water of extraction of potassium salts. STEIMMIG adds to it soda salts containing water of crystallisation and WAAGE prepares briquettes and tablets with calcium cyanamide, basic slag or finely ground phosphorites, a potassic solution, molasses, etc.

The granulated Norwegian product contains 1.6 % of nitrogen and only 9 % of dust, whereas calcium cyanamide treated with lime contains 44 %. Other methods of granulation are employed in North America and in France. But mechanical spreading is considered the best means of preserving the health of the workmen.

Much has been written regarding the use and the fertilising power of calcium cyanamide, or simply cyanamide (if prepared by the FRANK-CARO process), or calcic nitrogen (*Stickstoffkalk* if prepared by the POLZENIUS process). According to the author, the analytical determination of the dicyanodiamide (irreversible polymer of chemically pure cyanamide) which is considered to be poisonous, has a special interest (1).

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(1) The poisonous effect of dicyanodiamide on plants is disputed :— ULPIANI denies it absolutely and also PEROTTI and GUILLIN. From the results of his experiments. ULPIANI concludes that the cyanamide of calcium cyanamide passes early in urea in the soil whenever the soil is not poor in colloids; that opinion is shared by KAPPEN On the other hand the cyanamide would be poisonous when it remains unaltered as in excessively sandy soil. However, it is to be presumed that much of the want of success of cyanamide in these soils, attributed to the poisonous action of dicyanodiamide or to lack of microbial activity, is due to the absence or rareness of colloids. (Cf. SOAVE, *Chimica vegetale ed agraria* Unione tipografica editrice. Turin, 1915, Vol. II, p. 245).

On the other hand, according to the experiments of COWIE at Rothamsted, dicyanodiamide does not decompose in the soil and exerts a depressing action on the ammonification

Cyanamide is now used as a source of ammonia, nitrates and urea, which contains 46.7 % of nitrogen and is already used with good results as a fertiliser and a food. But owing to that high content urea is only applied to the soil, mixed with powdered lime or other inert matter. After having passed in review recent progress and recent works on agricultural chemistry relating to the questions the author sums up the development of the nitrogen industry in the various countries of the globe.

Germany. — The two great syntheses employed in that country are that of cyanamide, usually by the FRANK-CARO process and that of the direct production of ammonia by the HABER-BOSCH process. The direct oxidation of nitric nitrogen in the voltaic arc would require a large consumption of power; therefore very few factories utilise the PAULING process.

The cyanamide industry is oldest in Germany: it was tried before 1904.

The direct synthesis of ammonia developed enormously during the war; it is carried out on a large scale by the *Badische Anilin und Soda-Fabrik* at Oppau and Merseburg using the HABER-BOSCH process, special at present to Germany and which requires cheap coal and not electric power.

The *Badische Co.* prepares sulphate of ammonia (1), by double decomposition with local gypsum, and it also manufactures urea (44.66 % of nitrogen), nitrate of urea (34.15 %), chloride of ammonium (26.42 %), artificial nitre (16.5 %), double nitrate of urea and calcium (35 %), superphosphate of urea, bicarbonate of ammonium, ammonium-potassium nitrate, sodium-ammonium nitrate, nitrosulphate of ammonium, etc. But agriculture has still a certain mistrust of these new fertilisers, and therefore experiments and propaganda are necessary.

The *Nitrogen Syndicate* (Stickstoffsyndikat G. m. b. H.) with a capital of 1 066 500 000 marks was established in Germany on May 8, 1919 under the auspices of the Badische company.

Before the war (1913), German agriculture consumed about 180 000 metric tons of nitrogen combined with artificial fertilisers (400 000 tons of sulphate of ammonia, 560 000 of Chili saltpetre and 15 000 of synthetic products) and imported almost as much nitrogen with forage. In 1919, according to the Syndicate, the annual productive capacity of Germany was about:—

Synthetic nitrogen by the HABER process	300 000	tons
» » » » cyanamide »	100 000	»
» » » » dry distillation	100 000	»

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of protein matter, on nitrification and on vegetative growth (*R.* Oct., 1919, No. 1098). LEMMERMANN concludes from pot experiments that granulated cyanamide was injurious on account of its dicyanodiamide content which generally counteracts the power of assimilation (*Chemischer Zentralblatt*, Year 91, Vol. 3, No. 26, Wissenschaftlicher Teil, p. 940, Berlin, Dec 29, 1920). (*Ed.*)

(1) This association of synthetic ammonia with the SOLWAY soda process in the great work shops of Oppau, is, according to PARTINTON, who described it, one of the most interesting. Cf. *Journal of Chemical Industry*, v. 40, N. 6, p 99 London, March 1921 (*Ed*)

It is true, however, that in 1919 the real production was only 100 000 tons, which owing to difficulties in importing, caused a great decrease in the consumption of nitrogenous and phosphatic manures in Germany (1).

The German water-power resources are estimated by HALBFASS at about 11 400 000 H.P. of which about 4 000 000 are already developed (2). The largest electric generating stations in the world is being built in Bavaria ; its capacity is 6 000 000 kilowatts ; at present mixed plant, both hydraulic and steam, is used and the station is subsidised by the State. For storing power UNRUH has proposed to electrolyse the water and transmit the gas by means of a system of pipes to the place of consumption.

Austria-Hungary. — The *Economic Union of the Fertiliser Industry* was founded in 1918 at Trieste with factories spread over the old Austrian-Hungarian Empire. In the same year a factory was already working at Jablonica (Bosnia) and another at Bory (Galicia) ; the latter utilised the MOSCICKI process and produced annually 225 wagons of ammonium nitrate (3).

Bulgaria possesses one factory that makes carbide and chemical fertilisers at Poruschtiza.

Russia. — In 1917 a Company for working the BIRKELAND-EYDE process was formed at Petrograd, and the construction of a factory on the White Sea was proposed. A Russian Commission was sent to Germany to study there MEINER'S new process in the Skoda works.

Finland. — The proposed utilisation of the falls of the Imatra would yield 118 000 H.P. and those at Wych 600 000. A special Commission will decide whether the HABER process or the American cyanamide process will be adopted.

Norway. — This is the country of the arc process. The available water power totals 7 500 000 H.P. of which is 1.34 million H.P. is easily ultilisable and capable of furnishing about 5 000 000 kilowatts.

The cost of installation varies between 250 and 400 *crowns* (1 *crown* = 1.101 *shillings* at par) per kilowatt and the cost of working, including amortisation, between 10 and 15 % of the former. The current thus costs from 45 to 60 *crowns* per kilowatt year. In 1918, the *Norwegian Nitrogen and Hydro-electric Power Company* at Notodden, formed mainly with French capital, produced 350 000 H. P., which it intends to increase to 515 000 ; it is therefore the most powerful electric group in Europe. Another large company, the *Norsk Hydro Elektrisk Kvaelstof Aktieselskab* of Telemarken can produce annually 100 000 to 120 000 tons of synthetic nitric acid by the BIRKELAND-EYDE process ; a very large portion of it is transformed into *Norwegian saltpetre* (nitrate of lime with 13 % of nitrogen), nitrate of soda and nitrate of ammonia, the production of which tends to exceed that of Norwegian saltpetre. In addition, Norway produces annually 700 000 to 800 000 tons of cyanamide lime and the factories of Odda, since 1915, carry out granulation with satisfactory results.

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(1) That is why an active propaganda was undertaken for the fixing of nitrogen by biological means with leguminous plants chiefly lupins. See *R.*, Feb., 1921, No. 119. (*Ed.*)

(2) For the utilisation of water-power, see also *R.*, Oct., 1919 No. 1096. (*Ed.*)

(3) Two large cyanamide factories also exist at Sebenico and Spalato (Dalmatia) : their annual capacity is 56 000 tons (*Giornale di chimica industriale ed applicata*, Year 3, No. 1, p. 22. Milan, Jan. 1921). (*Ed.*)

In Norway, English and German companies, are also making synthetic nitrogenous products. The Norwegian-Icelandic Titan has also been formed for utilising hydraulic power in Iceland.

In 1918, the *Consumers' Union of the Norwegian Agricultural Society*, which has branches in Sweden and Denmark, founded at Bjölvefos, a co-operative factory with 43 000 H.P.; its annual production is 36 000 tons of cyanamide and 6000 of sulphate of ammonia. Recently the *Norsk Nitrid A.-S.* of Eydehavn has undertaken the manufacture of aluminium nitride by the Serpeck process.

Before the war Norwegian agriculture consumed 6000 to 7000 tons of nitrogenous fertilisers; in 1919, it consumed 80 000 tons of synthetic nitre, 2500 of granulated cyanamide, 43 000 of superphosphate and 2500 of cyanamide powder, used as a weed destroyer and made by the *North Western Cyanamide Co.* of Odda (1).

Sweden. — The production of cyanamide is especially developed in Sweden; the amount at present produced is 21 000 tons. The first large factory for atmospheric nitrate is expected to start working in 1923, and should produce 33 000 tons a year.

In 1919, the consumption of cyanamide was about 100 000 tons; for this reason the State is giving subsidies to favour home production.

United Kingdom. — The British Empire has water power reserves estimated at 50-70 million H.P., and it is proposed to establish an *Imperial Water Power Board.* Hydraulic power in Scotland could be obtained at a cost of £40 per H. P, or $\frac{1}{8} - \frac{1}{5}$ d. per kilowatt-hour.

The *Nitrogen Products Carbide Co.* a long time ago founded on important factory at Dagenham where it nitrifies ammonia derived from Scandinavian cyanamide. After 1915 the *Nitrogen Products Carbide Co.*, which amalgamated in 1919 with the *Alby United Carbide Factories Ltd.*, established a large cyanamide factory at Workington, intended to render England independent of Chile saltpetre. As there was a lack of nitrate during the war it was constantly necessary to manure with sulphate of ammonia and now the use of cyanamide is suggested to remedy the injury caused by prolonged use of ammonium sulphate.

The *Nitrogen Committee*, appointed in June 1919 with the object of promoting the installation of synthetic nitrogen factories in England, has taken up this interesting question and recommended, meanwhile, the foundation of the large factory of Billingham for the production of ammonium nitrate. Manchester has a nitric nitrogen factory which burns directly air in the electric arc, according to a direct process of the *International Nitrogen and Power Co.* of London, considered as very economical, in spite of the high cost of electric current in England. The experiments made to introduce the HABER process have had no results up to date (1) (2). The *Nitrogen Committee* ended its report by recommending strongly the creation of a rational synthetic nitrogen industry and the unification of English electric services.

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(1) In 1920, Norway exported in round figures 117 thousand tons of *norge*, 18.6 of nitrate of soda, 20.2 of nitrate of ammonia (*Chemical Trade Journal and Chemical Engineers*, Vol. 88, No 1770, p 359 London, April 1921. (*Ed.*)

Denmark. — The need for fertilisers has increased considerably in Denmark. Since 1918 the Government and the *Danish Society* have encouraged the installation of an experimental synthetic factory. But much Danish capital is employed in the *Fosseakeieselskabet Island*, which proposes to use the Thingvalla falls to furnish power to a factory which will supply Iceland and Denmark with synthetic nitrogenous fertilisers.

Holland. — Before the war, this country consumed 100 000 tons of Chile saltpetre and 40 000 of sulphate of ammonia. The restrictions imposed during the war have turned public opinion towards independence of foreign nitrogen. The Dutch Commission which dealt with the question concluded its report by recommending a preliminary investigation regarding the possibility of collecting organic waste (urine and peat litter), and the creation of factories to use the cyanamide or cyanide processes. The *Naamboze Vennootschap Stickstofbindings-industri*, of Dordrecht with a capital of 10 million *florins* (1 *florin* = 1.652 shillings at par), is to produce, by means of an American process, 2500 tons of fixed nitrogen at a price fixed by Government, which is subsidising the Company. In addition, 12 500 tons of sulphate of ammonia will be obtained by the cyanide process. There are no cyanamide factories.

France. — France is very rich in hydro-electric power the reserves being estimated at 10 million H. P. In 1914 only 805 000 H. P. was utilised, representing a capital of 350 million francs. At present about 1.5 million are used derived from rich alpine hydraulic reserves, which are utilised by two important French synthetic establishments, that at Notre-Dame de Briançon, which produce cyanamide lime by the FRANK-CARO process, and that of Roche-de-Rame, which produces nitric acid by the PAULING process. During the war only cyanamide was made, the production rising from 8000 tons in 1913 to 100 000 in 1918; however, since 1909, there has been an aluminium-nitride factory at Mulhouse, working on the SERPEK process, the patents of which now belong to the *Société d'aluminium française.*

In France nitric acid is generally made by catalytic oxidation rather than by direct combustion. In 1915-1916 the French Government requested the Anglo-Norwegian *Nitrogen Product and Carbide Co.* to instal in France factories to make cyanamide, nitric acid and nitrates by the processes worked out at Alby and Odda. It was intended to use the BIRKELAND-EYDE process in the Pyrenees. In 1919, among many French companies was founded the *Company for the investigation of nitrogen*, with the object of dividing between the associated Companies the HABER patent, obtained from Germany under the Peace Treaty.

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(1) At present, however, the English *Cumberland Coal, Power and Chemical Co., Ltd.*, which controls the English rights of the CLAUDE process, which uses higher pressures than the HABER process is about to instal works in Cumberland (*The American Fertilizer*, Vol. 54, No. 1, p. 76, Philadelphia, Jan., 1921. (*Ed.*)

(2) A modification of the HABER process is being worked by BRUNNER MOND and Co., but with what results is not yet known. (*Ed.*)

Recently G. CLAUDE, who synthesises ammonia at high pressures, has proposed to prepare chloride of ammonia with synthetic ammonia, by the SOLWAY soda process, in place of the sulphate, so as to obviate the high cost of sulphuric acid.

According to TISSIER the requirements of nitrogenous fertilisers in France in 1913 was 70 000 tons.

Switzerland. — According to AGTHE production by the HABER process is not economical in Switzerland; the same is true of the arc process and FIERZ thinks that the same applies to the SERPEK process. On the other hand the cyanamide process is economical. WINTELER estimates that the average cost of installation in Switzerland is 500 fr. per hydraulic H.P. and consequently a cost for current is 62.50 fr. per H.P.-year, or 1 centime per kilowatt-hour, a cost which will bear comparison with that in Norway.

Switzerland produces much calcium carbide but only 10 000 tons of cyanamide, of which 8000 tons. are consumed in the country. At Chippis and at Bodio nitric acid is made for the army by the PAULING process.

Italy. — This country was the first to start the real cyanamide industry by the FRANK-CARO process. In 1918 the old *Società Italiana dei Prodotti Azotati* of Piano d'Orte raised its capital to 9.9 million *lire;* it had produced 14 000 tons in 1914. The Firm of ROSSI of Legnano, which raised its capital to 20 million *lire* in 1920 makes nitric acid by the PAULING process and nitrate of potash and ammonia. An important electric establishment will be created at Domaso (1).

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(1) PARSONS states that the Italian chemical industry will be very successful (*The Journal of Industrial and Engineering Chemistry*, Vol. 12, No 9, p. 907, Easton, Pa., Sept., 1920) Five cyanamide factories are at present working in Italy; they produced, in 1919, 16 800 tons of this product (Ministry of Industry and Commerce, *Annuario per le industrie chimiche e farmaceutiche*, V. 2, pp. 112 and 113. Rome, 1919) and 28 000 in 1915. A sixth factory is under construction at Domodossola and the productive capacity of the 6 factories is estimated at 80 000 tons of cyanamide.

The two factories of the Firm of ROSSI produce nitric acid.

As in many other countries, the important question of synthetic nitrogen has led, also in Italy, to the creation of a *Commissione per l'azoto*, appointed in December, 1919. After its return from Germany it made the following recommendations:— that the national production of synthetic nitrogen should be increased so as to meet the requirement of 50 000 tons forecasted for a few years hence; that the synthetic ammonia method should also be used by the use of electrolytic hydrogen (*Giornale di Chimica Industriale ed applicata*, Year 3, Nos. 1 and 2, pp. 20 and 64. Milan, 1921). A new elementary synthetic ammoniacal process of CASALE, based on the same catalytic synthesis as that of HABER, but preferable to that of HABER and CLAUDE on account of its economy and simplicity, is being discussed in Italy; it has already been tried with success by the *Idros* Co at Terni: the patent has been bought abroad but with reservation of the right of manufacture in Italy. (*Il Coltivatore*, Year 67, No. 16, p. 499. Casalmonferrato, June 10, 1921). (*Ed*)

Spain. — The *Compañia Navarra de Abonos Quimicos* of Pampelune, founded in 1918, projected the construction, at Viana, of the first factory of atmospheric nitric acid and its derivatives, working on the NORSK-HYDRO patents: the river Ebro supplies 8000 H.P. The second factory (75 000 hydraulic H. P.) is to be installed at Lerida and the third at Corcubion.

In 1918, Spain consumed 60 000 to 70 000 tons of sulphate of ammonia, chiefly in the ricefields of Valencia.

United States. — The development of industrial synthesis in the U. S. is of special interest. The first products were manufactured by the *American Cyanamide Co.*, founded in 1907, which produced in 1913, with power furnished by the Niagara falls, 64 000 tons of cyanamide by the FRANK-CARO process. During the war the great industry of catalytic ammonia oxidation using ammonia obtained from cyanamide and coke ovens developed to such an extent that 5 big works capable of producing 225 000 tons of nitric acid annually were working in 1918. In 1917 the above mentioned company and the Government founded the *Air Nitrates Corporation* with the object of creating large cyanamide factories; in 1918 the Muscle Shoals factory on the Tennessee, in Alabama (Nitrate Plant No. 2) was working; it cost $18.6 million (1 dollar = 4.86 shillings at par), employs 34 000 workmen, and produces, with 90 000 kilowatts, 110 000 tons of nitrate of ammonia annually. The American Government spent another $20 million on the factory at Sheffield, Alabama, which can produce 220 000 tons of nitric fertiliser by the *General Chemical Co.*, process, based on that of HABER, recognised as unexceptionable by PARSONS.

The BUCHER cyanamide process, favourably reported on by PARSONS, has recently become very important; it is worked by the *Nitrogen Products Co.* and produces cheaply by the thermic method. Cyanide of ammonia, urea, and, with the help of current, oxamide, a substance almost insoluble in water which forms, according to BUCHER an excellent fertiliser, are obtained. Recently the U. S. Government has devoted $70 million to the installation of synthetic nitrogen works, and has established a Nitrogen Commission. PARSONS estimates the cost of production of 1 ton in America as follows (page 1123).

The hydraulic power utilised in the United States up to 1917 amounted to 4.4 million H.P. But the *American Cyanamide Co.* also works on the Canadian side of the Niagara Falls and in the port of New York, where the *Ammo-Phos-Corporation* will prepare phosphate of ammonium (*Ammo-Phos*) by the WASHBURN process.

The arc process is little used. There are 3 small factories, subsidised by Government, which produce 2 000 to 3 000 tons of nitric acid by the WIELGOLASKI process.

One third of the total production of synthetic nitrogen in the whole world is furnished by the United States, where the production is more than three times the requirements of the country, in spite of the still very considerable imports of Chile saltpetre.

	Process			
	Voltaie are	Cyanamide	HABER	*Gen. Chem. Co.*
Products :	HNO_3 96 %	NH_3	NH_3 35 %	NH_3
Power required.	10.5	2.2	0.2	0.2
Installation capital . . *dollars*	1 410	440	540	300
Cost of working »	170	150	119	97
Products:	HNO_3 96 %	HNO_3 96 %	HNO_3 96 %	HNO_3 96 %
Power required.	10.8	2.3	0.3	0.3
installation capital . . *dollars*	1 550	670	570	520
Cost of working »	220	270	23[illegible]	217

Canada. — Estimates of the water power vary between 14 and 18.8 million H.P. Of these, 2 million H. P. is already developed and another million is being developed. It is proposed to use the gassy springs of pure nitrogen in the Fraser valley, in British Columbia, and those of the islands in the gulf of Georgia, for the manufacture of cyanamide. In British Columbia, which possesses 3 million hydraulic H.P., of which only 250 000 are utilised, the *American Cyanamide Co.* produces cyanamide from which it makes nitric acid, nitrates, urea, phosphate of ammonia, etc. A factory is also to be constructed to produce 2000 tons by the WIELGOLASKI process.

South America. — No factory is known to be already working. In the Argentine there is talk of using the Iguazu falls, which resemble those of Niagara. In Brazil there are 10 large falls which could supply 26 million H.P.

Asia. — Turkey does not possess any establishments of the kind. In Japan for some years now the *Nippo-Tisso-Hyrio-Kabushiki-Kaiska* (Limited Company of Nitrogenous Fertilisers), of Osaka, has produced cyanamide by the FRANK-CARO process. The same applies to another electrochemical company. A new factory was installed at Fukui in 1918, so that Japan also is progressing towards real or potential economic independence as regards nitrogenous products. Up to the present the arc process is not used industrially, but the Government is constructing a factory to use the HABER process or its American modification.

There is also talk of constructing a fertiliser factory in Korea.

In British India the projected factory at Burhar should supply 5000 tons of cyanamide per annum, to be used directly or to be transformed into ammonia salts, especially for manuring ricefields and sugar cane, the relative production of which is very low compared with that of the neighbouring Dutch Colonies.

Africa. — In the south there are two English companies which produce 2000 tons of sulphate of ammonia and work the local mines of nitrate of potash. Another company, was formed in 1919, to produce fertilisers in Egypt. In the Canary Islands large quantities of fertilisers are used for the banana crop.

Oceania. — Already nitrated lime has been produced in Oceania.

II. — PROGRESS OF THE ELECTROTECHNICAL INDUSTRY FROM 1916 TO 1919. — This is another interesting review of the whole electrotechnical industry during recent years, with information regarding new inventions and patents. The following is an abstract of the parts most interesting from an agricultural standpoint avoiding repetition of the information already given above.

Contrary to the opinion of DOLCH, MEINGAST considers that the Swedish CARLSON process is the best for the preparation of cyanamide. LIECHTI and TRUNINGER are of opinion that to estimate the commercial value of cyanamide, at least as much importance should be attached to the determination of dicyanodiamide as to the determination of the total nitrogen. Numerous contradictory experiments made with cyanamide could, according to MEINGAST, be probably explained by the different content of the cyanamide in dicyanodiamide, which is considered to be poisonous. The experiments of the Swiss Establishment of agricultural Chemistry at Berne-Liebefeld that TRUNINGER has reported, have shown, according to the author, that dicyanodiamide has a specially poisonous effect on oats. For spreading cyanamide in the fields, HUSEN recommends that the workman should be powdered or greased.

In Germany the Nitrogen Syndicate has fixed the proportion 8 : 9 : 10 between the unit prices of cyanamide, ammoniacal and nitric nitrogen.

ANDRIESSENS deals theoretically with the voltaic oxidation of nitrogen and shows that the greatest yield is obtained with a mixture of equal parts of nitrogen and oxygen ; this is why the synthesis of cyanamide should exist in the industry side by side with voltaic oxidation.

III. — REVIEW OF THE PROGRESS OF THE FERTILISER INDUSTRY FROM 1913 TO 1920. — WICHERN gives information regarding the progress made by the potassic, phosphatic and nitrogenous fertiliser industries. We restrict ourselves here to nitrogenous manures, for which the author refers to the previous review of VAESER.

Artificial nitre, unlike natural nitre, does not contain injurious chlorates. Nitrate of ammonia, a concentrated fertiliser, cannot be transported because it is explosive and hygroscopic. Ammonium-potassium nitrate with 15 % total nitrogen, half nitric and half ammoniacal, and with 25 % of potash, and ammonium-sodium nitrate, with 19 % of nitrogen, has not the same obnoxious proporties as nitrate of ammonia. Nitro-sulphate of ammonia (1), with about 27 % of nitrogen, and chloride of ammonia, owing to their novelty, have not yet obtained favour with farmers who remain faithful to sulphate of ammonia. Urea, with 47.6 % of nitrogen is the richest of nitrogenous fertilisers ; it is generally prepared industrially by the reaction of ammonia in carbonic acid in a closed heated chamber and then distilling the product at 80° C. But the hygroscopicity of urea prevents its use as a fertiliser, so nitrate of urea and calcium is prepared, which contains 34 % of total nitrogen (7 % in nitric form), is easy to spread and to store (1). Bicarbonate of ammonium is also prepared (2).

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(1) Germany ceded this fertiliser to Belgium, including it in the war indemnity (*Journal de la Société Nationale des agriculteurs de Belgique*, Year 3, No. 17, p. 121. Brussels, Apr. 1921). (*Ed.*)

In spite of the development of the direct synthesis of ammonia the cyanamide process is still very important, because it supplies a directly utilisable fertiliser which does not require subsequent transformation. The principal drawback to cyanamide is its extreme fineness of division and to obviate this, treatment with neutral oil is used and will continue to be used successfully. It would be interesting to find a means of neutraising the calcium oxide without altering the cyanamide.

If bricks of cyanamide are prepared a granular product with only 9 % of dust (against 44 in the oiled product) can be obtained but the process is very expensive.

A new nitrogenous superphosphate has been obtained by mixing superphosphate with synthetic urea. It is very hygroscopic but several patents have been taken out to obviate this defect; its richness in nitrogen renders it easily negotiable and exportable. Mixtures of superphosphate and cyanamide are not recommended owing to the reversion of the phosphoric acid.

If superphosphate is saturated with ammonia, GERLACH ammonium phosphates are obtained. This contains on an average:— 2.42 % hygroscopic moisture; 33.71 % sulphate of ammonia; 2.74 % bicalcium phosphate; 30.1 % tricalcium phosphate; 22.55 % calcium sulphate; 2.96 % phosphates of iron and aluminium; 4.26 % silicates, etc. The phosphoric acid of the original superphosphate is effectively retrograded, but 16.27 % (out of 16.73 % total) is soluble in a 2 % citric-acid solution. Of the ammoniacal nitrogen 6.47 % (total 6.61 %) is soluble in water.

Cultural tests, using equal contents of nitrogen and phosphorus, have proved the equality in fertilising efficiency of GERLACH ammonium superphosphate and the ordinary mixture of superphosphate and ammonium fertiliser. Another similar product has been prepared by WILLSON with double superphosphate and ammonia gas.

The GERLACH process, which is not yet used industrially, has against it the fact of phosphoric reversion. But KLINGBIEL concludes from one of his investigations that the method of estimating superphosphate used at present in Germany, which is based exclusively on the estimation of the water-soluble acid, requires to be modified. This is so much the case that since August 1, 1919 (thus satisfying an old desire of local manufacturers) citric-soluble phosphoric acid is just as dear in Germany, which is all the more opportune because at present German phosphorites, rich in iron and aluminium, are increasingly exploited (1).

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(1) Urea affords great promise as a fertiliser for tobacco. See *R.*, May, 1921, No. 394. (*Ed.*)

(2) As well as BURKEISER's salt, which is a mixture of sulphite and sulphate of ammonium (GREGOIRE, Les engrais nouveaux, in *Annales de Gembloux*, Year, 27, Nos. 3 and 4, Brussels, 1921 in which all the synthetic products are clearly reviewed). (*Ed.*)

IV. — INDUSTRIAL USE OF CYANAMIDE. — Review of a recent book by ESCARD (2).

Cyanamide, in powder, easily carried away by the wind, requires transformation. The most simple operation is granulation. Modern granulation processes allow granulated cyanamide to be obtained at a high strength (19-20 % of nitrogen) with a high content of calcium oxide which facilitates a return to the dusty state as soon as it is incorporated in the soil. This product is sold in tins containing 75 kg.

Ordinarily, cyanamide is granulated by kneading it with a little air. Sometimes clay soil, casein and water are added. In the SAVÈS process, the cyanamide is mixed with a solution of potassium silicate, then dried ; granular cyanamide is obtained having 12.10 % of nitrogen and 1.62 % of potash or other strengths, and is applied in autumn.

The SINCLAIR process of granulation consists in the addition of hot water followed by drying the product during shaking. Briquettes are made by kneading followed by drying and breaking into granules.

Cyanamide oiled with 4 % of heavy oil is then granulated and has the advantage of not being hygroscopic ; 15 % of tar can also be added to cyanamide.

Cyanamide is also valued for its content of lime, iron and manganese. It is suitable for all soils, except soils rich in nitrogen and very sandy soils : it has given excellent results in ricefields. Its effect lasts over a year and it nitrifies slowly. It can be mixed with basic substances, but not with ammonium salts and not even with superphosphate.

891 - **The Mechanism of the Decomposition of Cyanamide in the Soil.** — COWIE, G. A. (Rothamsted Experimental Station, Harpenden), in *The Journal of Agricultural Science*, Vol. X, Pt. 2, pp. 163-176, figs 5, bibliography of 10 works. Cambridge, May 1920.

In a preceding investigation the author showed that cyanamide readily breaks down, yielding ammonia in normal clay and sandy soils. The experiments here discussed confirm the view held by ULPIANI as a result of his later work, namely that cyanamide breaks down by a purely chemical change to urea which is then converted into ammonia.

In the experiments carried out by ULPIANI, culture solutions of various concentrations and at various temperatures were employed, whereas the author conducted his experiments in soil under natural conditions, using amounts of cyanamide comparable with those used in practice. No appreciable amount of ammonia as a result of the decomposition of cyanamide in sterile soils was evident (heated to 120° or 135° C.). The addition of the urease of soya-bean, however, produced considerable quantities of ammonia in these soils which indicated the presence of urea, later confirmed in the laboratory. Further experiments demonstrated that urea actually remains stable in soils heated to 120° C. The addition of cyanamide to sterile soils thus leads to an accumulation of urea, which persists as such in consequence of the suppression of the necessary urea decomposing organisms. Similarly the addition of cyanamide to soils heated to 100° C does not lead to immediate production of ammonia but yields urea, which decomposes after the recovery of the appropriate organisms. There is on the other hand, evidence of a rapid and progressive production of ammonia arising from the decomposition of cyanamide in unheated normal clay and sandy soils. However, examination of these soils revealed in the initial periods the presence of appreciable amounts of urea.

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(1) According to NEUBAUER, who has dealt with GERLACH ammonium phosphate, the fertilising effect of dicalcium phosphate, soluble in 2 % citric acid, is almost the same as that of water-soluble monocalcium phosphate, except for a soil very poor in phosphoric acid or for plants with a reduced root system, as in young beet plants (*Die landwirtschaftlichen Versuchs-Stationen*, Vol. XCVII, Nos. 1 and 2, p. 20. Berlin 1920). (*Ed.*)

(2) *Production industrielle synthétique des Composés nitrés et leurs dérivés.* Dunod, Paris. (*Ed.*)

The cumulative evidence thus leads to the conclusion that cyanamide in the soil is normally converted by a purely chemical process into urea and independently of the activity of micro-organisms. The urea is then broken down into ammonia by means of soil organisms. Cyanamide appears to behave in this way in both clay and sandy soils, but the decomposition seems to be more rapid in the former case. The experiments have conclusively shown that cyanamide does not decompose into urea in ordinary impure quartz sand; whatever the decomposing agent may be it is not present in pure sand. In one special case sand has been shown to contain a constituent resembling a zeolite. In any case cyanamide does not appear to decompose in the manner above indicated in peat and fen soils; in these it gives rise to a relatively small production of urea under normal conditions.

892. — **Assimilation of Phosphoric Acid and Reaction of the Soil** — See n° 894 of this *Review*.

893 — **Fertiliser Tests in Iceland.** — See n° 881 of this *Review*.

894 – **Factors influencing the Assimilation of Fertilising Matter by the Plant.** — WRANGEL, M., in *Die landwirtschaftlichen Versuch-Stationen*, Vol. XCVI, Pts., 5 and 6, pp. 209-262, 3 pl. Berlin, 1920.

In a preceding work (" Ein estländisches Rohphosphat und seine Wirkung auf verschiedene Pflanzen ", *Die Landw. Versuchs-Stationen*, XCVI, 1), the author has shown that different plants use the phosphoric acid of slightly soluble phosphates, in very unequal quantity. To study this phenomenon, cultural experiments were undertaken and the assimilation of phosphoric acid by the plants relatively to a different reaction (alkaline, neutral, acid by inorganic and organic acidity) of the soil solution and of the soil itself was observed.

With this object, fertilisers were used in mixture which had a neutral reaction; but if care was taken to supply equal quantities of fertilising foods, they were given in a different form and assorted so that a first group of tests remained neutral, the second became alkaline, the third acid had a citric acidity and the fourth acid a sulphuric acidity; moreover, a certain number of parallel tests were treated with calcium carbonate in quantity exceeding that necessary to neutralise the acidity which might eventually develop. The reaction of the soil, or rather of its solution, was controlled during the whole experiment and the effect of it on the assimilability of phosphoric acid, tricalcium phosphate, dicalcium phosphate and natural phosphate was studied first in a preliminary series of experiments with maize, then in a second with mustard. The soil used consisted of quartz sand but contained 0.097 % of lime, partly as carbonate and partly as silicate, which was neutralised, in the first group, by $^2/_3$ of sulphuric acid and $1/3$ of nitric acid, in the third group by citric acid, and in the fourth group by sulphuric acid, while the second group was used untreated. Each pot contained 6 kg. of this sand, and the fertilising substances were applied in quantities of 1 gm. per pot for each of the elements (nitrogen, potash and phosphoric acid) and 5.9 gm. for lime in the form of various salts. The MERCK tricalcium phosphate used contained 40.43 % of phosphoric acid, of which 2 % was soluble in citrate of ammonia; the dicalcium phosphate contained 40.24 % of phosphoric acid (38.8 % soluble), and the natural phosphate (Esthonian oolite) 20.37 %, of which 3 % was citric soluble. The pots were kept at 10 % of moisture; the sand used contained 0.01 % of manganese, traces of iron, aluminium and sulphuric acid, as well as a certain amount of potash.

The results obtained showed that the maize used only the slightly soluble phosphates when there was an acid reaction due to complementary manuring that was physiologically acid; the addition of lime caused the effect of the acidity to cease completely and consequently also the assimilation of phosphates. Mustard however could assimilate phosphoric acid from the slightly-soluble phosphates, even in the presence of a rather alkaline reaction, and this took place also independently of liming and even to some extent of the alkaline or acid reaction except when the intensity of the reaction was such as to give rise to effects that were toxic or harmful in some other way

The maize assimilated the lime relatively to the phosphoric acid in the proportion of 3 molecular weights of one for 1 of the other; mustard, for the same quantity of phosphoric acid, consumes 15 molecular weights of lime; the proportion lime: phosphoric acid enables an estimate to be made of the aptitude of plants to use phosphoric acid and causes, at the end of vegetative growth, a change of reaction in a soil that at first was neutral. The process of dissolution of fertilising substances in the soil appears primarily to differ from an alternate absorption of cations and anions and from the oscillations of alkaline and acid reactions which are thus generated. Normally it appears that there is, at the commencement of the vegetation, an accelerated absorption of cations, favourable to a more intense assimilation of phosphoric acid in the second stage of growth; when basic or acid solutions are added they hasten the appearance of the process of nutrition of the plants to such an extent that they may be considered as catalysts. Nitrogenous manuring has special importance, inasmuch as, if it is applied opportunely, it regulates not only assimilation but also the reaction of the soil solution; in fact, nitrogen may be applied in the form of cation as ammonia, of anion as nitric acid, or else in the form of nitrate of ammonium, which may help to create an optimum reaction for the plant.

Free citric acid is decomposed in a few days in the soil, while the presence of carbonic acid in the soil appears to play an important part in the phenomena of dissolution and transformation.

These statements seem to throw light on several phenomena, such as:— The contradictory results of liming; the exhaustion of the soil and rotations; the sensitiveness of certain plants to lime in spite of a relatively high requirement of lime; the formation of colloids in the circuit of the root system owing to the alternation of the acid and alkaline reaction.

895 - **The Necessity for Establishing a Plant Breeding Station in the Argentine for the Application of Genetics to Agriculture.** — GIROLA, C. D, in the *Anales de la Sociedad Rural Argentina,* Year LVI, Vol LV, No 6, pp 205-212, figs. 2 Buenos Aires, March 1921.

In spite of previous attempts the problem of the selection of wheat in the Argentine is still, according to the author, in the early stages and offers a very large field for research and work to scientists and technicians.

The selection of wheats should be commenced on indigenous or acclimatised varieties, first of all on the *Barleta* (*Triticum sativum* L. var. *Barleta* Gir.) which is still largely represented, although it is rarely met with in a pure state; it has always given good products with respect to quality and quantity. The ease with which it adapts itself to all zones from north to south in the wheat region, facilitates the isolation of subvarieties that are early or late forms which suit different climates and different soils. The following varieties merit, as plant breeding material, special attention: —

Ruso (*Triticum sativum*) L. var. *Ruso* Gir) semi-bearded, which is characterised by its adaptation, its resistance to diseases and to husking, its chemical composition, its productivity, etc. The *Italian* or *Lombard* wheat, bearded, early, good producer, specially suitable for early sowing in fertile soils, though inferior to the two preceding varieties in resistance to husking, should also be selected.

Among beardless wheats the *French* (*Triticum sativum* L var. *Frances* Gir.) is remarkable; it is soft, of excellent quality: among hard wheats preference will be given to *Candeal* (*Triticum durum* Desg. var. *Candeal* Gir.) which owing to the heterogeneity of forms which compose its populations lends itself to opportune selection by pure lines

Good results may be obtained by crossing *Candeal* with *Taganrok* (*Triticum durum* Desf. var. *Taganrok* Gir), the peculiar hardiness of which added to the good qualities of Candeal would doubtless increase the productivity.

Japanese wheat should not be overlooked as, on account of its great earliness, it might be used for the production of kinds suited to the southern regions (with short summer) and also to the northern provinces where late kinds are liable to scorch.

In the preliminary period, however, the work should be limited to a restricted number of varieties, taking as basis the hard wheats " *Barleta* " and " *Ruso* ".

For the complete and methodical realisation of the programme of plant genetics applied to agriculture a large central plant breeding Station is required situated so as to be able to command the greatest possible area under wheat, to ensure the maximum application of the results which may be obtained.

For this a locality should be chosen in the west or north-west of the Province of Buenos Aires, or else in the south or south-west at Santa Fé, or else in the south-east at Cordoba.

The Central Station should be assisted by sub-Stations suitably chosen and situated with regard to climatic and agro-geological conditions in each district.

The varieties of wheat, both Argentine and acclimatised, are increasingly confused and mixed, so that they now form very heterogeneous populations; the improvement in the quantity and the quality of the product which may certainly be expected from selection will largely compensate for the cost of installing the new service.

896 - **Plant Breeding at the Central Development Farm, Weraroa (New Zealand).** — BEVERLEY, L., in *The New Zealand Journal of Agriculture*, Vol XXII, No 5, pp 290-291, fig. 1. Wellington, May 20, 1921.

CLOVERS. — RUNCIMAN's red clover as the result of numerous tests may now be regarded as the only true perennial strain of red clover existing in New Zealand, and it should prove of very great value in the improvement of pastures in the Dominion.

In 1914, several selections, were made in the Auckland district, and further selections were made a year later at Moumahaki, an interesting collection of different types being secured. Recently one of these selections (B95) was isolated and is to be known in the future as "Weraroa white clover." It is distinguished by its active growth, good sized leaves and seed heads, and by its great yield and truly perennial character. This clover promises in a few years to become the standard white clover for New Zealand.

GRASSES. — The Moumahaki cocksfoot (*Dactylis glomerata*) is a pure line cocksfoot obtained locally and noted for its complete immunity to smut. Equally good results have been obtained with *Poa laxa.*

LUCERNE. — A yellow flowered selection of " Chermo " lucerne, characterised by the abundant production of under-ground stems has been given a trial. It has given every indication of great value as a grazing lucerne, but up to the present the form has not been properly fixed.

PEAS. — These experiments were made with a view to producing types of peas giving more than a pair of pods on a stem, i. e. triplet types. Successful results have been obtained with Weraroa Strategy and Weraroa Imperial. Work is proceding to tripletise field varieties such as Early Minto, Egyptian and Partridge.

Owing to the heavy winds in the spring at Weraroa, a pea which branches well at ground level is desirable. Numerous varieties were tested and Sutton's Late Green Marrow was undoubtedly the best, and was crossed in 1918 with a triplet pea. The most forward of these new types are now in the F_3 generation.

897 - **Inheritance of Length of Internode in the Rachis of Barley.**— HAYES, H. K., and, HARRY H. V., in *United States Department of Agriculture*, Bulletin No. 869, pp. 1-26 2 pl. Washington, September 1920.

A series of experiments on the inheritance of the length of the internode in the rachis (density) of barley was undertaken in 1915, in collaboration with the Minnesota Agricultural Station. This character is well suited for such researches for the following reasons:

1) In a pure line, it varies within very small limits;

2) Many varieties present a scale of values as regards length of internode.

The pure varieties examined had three degrees of density, which are also used by systematic botanists in describing 6-rowed barleys (loose, compact and very compact).

Hordeum vulgare pallidum (6-rowed, hairy, awned, white).
Sub-variety *typicum*, lax ear, pure Mandchuria line.
» *parallelum*, compact ear, pure Reid Triumph line.
» *pyramidatum* very compact ear, pure Pyramidatum line.

Hordeum distichon palmella (2-rowed, hairy, awned).
Sub-variety *nutans*, lax ear, pure Hanna and Steigum lines.
» *erectum*, compact ear, pure Svanhals line.
» *zeocriton*, very compact ear, pure Zeocriton line.

Many crosses were effected with these pure lines.

F_1 *Generation.* — Mandchuria (360) × Svanhals (458). The average density in the case of Mandchuria is 3.34 ± 0.01 and in that of Svanhals 2.53 ± 0.01; in the hybrid however we find 2.70 ± 0.01 with the almost complete dominance of the compact over the loose ear.

Pyramidatum (476) × Jet (454); the density of the former being 2.11 ± 0.01, and that of the latter 3.92 ± 0.01, the density of the F_1, was 2.86 ± 0.01. Unlike the preceding case, there were thus some almost intermediate forms (= 3.01).

F_2 *Generation.* — In the second generation the number of plants studied was rather small; it was, however, possible to state that the F_2 hybrids showed much greater variability than the F_1 individuals or their parents.

Thus the coefficient of variability for the F_1 of Mandchuria (360) × Svalhals (458) was 6.30 ± 0.30 whereas in the case of the F_2, this coefficient was 10.20 ± 0.27 (in 1916) and 11.82 ± 0.48 (in 1918.

Though the maximum variation of Pyramidatum (476) was $6.16 \pm 0\ 21$

and that of Jet (454) 6.93 ± 0.39 mm., the maximum variation of the F_2 resulting from Pyramidatum × Jet was 16.44 ± 0.52 in 1916, and 18.38 ± 0.81 in 1918.

F_3 *and* F_4 *Generation.* — In the third generation, the phenomena of segregation show themselves, and groups of descendants appear, which have the same variability as their parents if the line is pure. The careful investigation of the abundant F_4 material proved the purity of some of these F_3 lines. From the cross Mandchuria (360) × Svanhals (458) 32 F_3 lines were bred, which represented all the degrees of density found in the F_2. Five of these lines, or types, transmitted their characters unaltered to the F_4, which proves their homozygous nature. For these 5 types, the values of the average density are as follows:

378 — 1 average density = 2 57 ± 0 01 mm.
378 — 11 » » = 2 64 ∓ 0.01 »
378 — 14 » » = 3.37 ± 0.02 »
378 — 23 » » = 2.55 ± 0.01 »
378 — 31 » » = 2.58 ± 0.01 »

The 378-88 selection gave the highest coefficient in the F_3; 2 fine ears were bred to the F_4, and produced progeny with a density near that of the Mandchuria parent.

Similar cases were met with in the Pyramidatum × Jet progeny; the extracted homozygotes always having densities similar to those of their parents, no intermediate values occurring.

From the crosses Hanna × Reid Triumph, and Hanna × Zeocriton, in the F_3 and F_4 homozygous individuals were obtained having a density intermediate between that of their two parents, and pure homozygotes with a density near the density of their parents.

Analysis of results. — The appearance in the F_3 and F_4 of individuals that were homozygous as regards density, justifies the belief that even the character of the length of the internode in the rachis of barley is governed by genetic factors.

It is not easy to determine the number of factors involved, but from the behaviour of Mandchuria × Svanhals, and of Piramidatum × Jet, it would appear that there is only one.

On the other hand, the results obtained with Hanna × Reid Triumph would seem to show that 2 factors with cumulative effect are at work, their simultaneous presence giving rise to extrinsic types, and extreme values. If either factor is wanting, intermediate values result.

From Hanna × Zeocriton were obtained homozygotes similar to their parents, and 2 homozygotes of distinct intermediate values. The phenomenon can be explained by the existence of 3 independent genetic factors of which each is allelomorphic as regards its absence.

898 - **Observations and Researches on the Sugar Beet.** — MUNERATI, O., in the *Memorie della Reale Accademia dei Lincei*, Serie V Vol. XIII, Part. V, pp. 175-322, 12 Pl., figs. 7 and 274 bibliographic quotations (Bibliography up to the end of 1919). Rome, 1920.

The author considers the problem of improving the sugar beet in the conditions surrounding it in southern countries; this environment is known to be very different, from an ecologic stand point, from that in which the sugar beet was originally improved. For this investigation the Italian Government founded in 1910, a special experiment Station at Rovigo, in the centre of the region in Italy where beet cultivation is most intense. Besides the large resources which the Government has given to it, the Station receives contributions from manufacturers

As the subject, considered both broadly and in detail, is necessarily connected with subordinate and collateral problems, the author investigates, together with fundamental questions, others which depend indirectly on the former and which more or less elucidate them.

The memoir is divided into 12 chapters.

CHAP. I. — PRELIMINARY PART. — After having pointed out that the sugar beet has not yet been thoroughly studied from a genetic standpoint (the bibliography on this subject is fragmentary and uncertain; the species has, in fact, been studied rather from a chemical than from a biological standpoint), and after having considered the direct and indirect difficulties to overcome in the choice of material for selection, the author puts forward several questions. Should the choice of parent plants be made where the beets are generally richest? Is the crop more assured in southern countries when seed from the north is used? And, on the other hand, do the high power of germination and the remarkable initial vigour of young plants raised from seed of southern countries constitute sufficient qualities for the seed of the south to be preferred to that of northern countries? Are there real differences in the hereditary attributes of commercial varieties of sugar beet?

With regard to the first question, perhaps the most important from a practical point of view, the author remarks that selectors have always had a strong tendency to concentrate the choice of parents in regions which have the finest beets. Thus in Central Europe most firms which are engaged in selection have preferred the regions where the beets contain the greatest percentage of sugar, such as Saxony, Anhalt, the plains of Bohemia on the Prague side, etc Perhaps one of the reasons why French selectors have had no luck, even in France, is to be found in the prejudice and distrust, both of sugar manufacturers and growers who sell by density, against seed collected from beets such as they are in France, always poorer than those of Central Europe. The author naturally places the problem in the long list of those attaching to the *vexata quaestio* of the heredity of acquired characters. Can a modification produced by environment be transmitted? In this special case, can the capacity of a beet to accumulate more or less sugar in its root, in consequence of the special conditions of environment in which the plant happens to grow, become a hereditary attribute? Can the environment, by a cumulative process through a succession of a greater or smaller number of generations, determine the formation of new genetic factors, or at least, modify pre-existing factors? Or else, can the stimulus of certain external conditions give rise to new forms (mutations), which the selector can thus obtain? Now, up to the present, the support of experimental researches instituted purposely to reply to these questions has been wanting; it must even be added that a perfect experiment of this kind is not easily made, inasmuch as it would be extremely difficult to estimate all limiting factors and to define every possible cause of error, even admitting that a pure type has been taken as a starting point — which is not easy to prove.

Regarding change of seed, can it be said that it has been proved experimentally that the use, in a given region, of a seed produced under different climatic conditions can act as stimulant on the said seed? Certainly the " degeneration " of types and the declared necessity for changing seeds generally have been much exaggerated, and, in any case, the attribution to change of climate of certain presumed modifications of form and colour of the roots, tendency to bifurcation, etc., facts only attributable to phenomena of false adaptation or of proximity, must be excluded absolutely. But on the other hand there is equal exaggeration when the qualities of seeds obtained in southern countries are extolled for their strong germinative power; it is in this case an attribute that is agronomic or environmental rather than genetic.

Lastly the author is inclined to admit an equivalence among the " varieties " of sugar beets, which, instead of being so designated, ought to be called " trade brands ".

CHAP. II. — STUDY OF CORRELATIVE VARIABILITIES. — The subject necessarily attracted from the commencement, the whole attention of the experimenter. Observations were made on: — The appearance and aspect of the foliage; the foliage as a quantitative whole; the tendency of beets to grow out of the ground; the length and other external characters of the roots; the sugar content relative to the weight, etc. As most of the study undertaken in this respect in regions where beet is grown in the northern countries, cannot serve as a guide to experimenters in southern countries, it is concluded that, except in very special cases, the selector seeks in vain to find means of guidance from the biometric examination of the material which he possesses. On the other hand, the study of numerous correlative variabilities, which might be a real help if the choice of beets was made exclusively according to external characters ceases to have any practical value from the moment when, by a polarimetric determination, the domain of conjecture is left and support is given by the solid ground of figures.

CHAP III. — THE SUGAR BEET IN ITS RELATIONSHIP TO THE ITALIAN CLIMATE. — After having dealt at some length with the more important contributions to the question by previous investigators, and especially by H. W. WILEY in the United States, the author considers the Italian centres that are most characteristic from a climatologic standpoint and dwells on the most difficult problem of the growth of beet in southern countries, which is the phenomenon of retrogression.

If retrogression, he concludes, is chiefly the expression of a problem of distribution of rainfall or of economy of water, other causes may act at the same time cumulatively or independently; loss of sugar in beets is always connected with renewal of growth after summer and autumn rains; the reserve of sugar in the roots can also decrease without the intervention of rain and consequently without the necessity of the phenomenon of a sudden renewal of vegetation. "It will certainly be possible, by the help of intelligent expedients, to diminish the consequences of a rapid retrogression, industrially intolerable, and it is also not altogether improbable that types may be found in which the tendency is found in a slighter degree; but until the contrary is proved, the lowering of the percentages is considered, under the climatic conditions that hold in the valley of the Po, as absolutely inevitable."

As the biologist tends to adapt given races to fixed conditions of environment, the author asks himself whether, in research work on local races, the selector does not find himself sometimes in the presence of factors so stubborn as to render his work extremely difficult. For example can the principle of the wide expansion of the leaves (universally accepted as a basis of selection) be rigorously applied in climates where high temperatures, scarce rainfall and strong sunshine cause the leaf system to transpire enormously? And cannot a race whose above-ground system is reduced, present in its turn other serious drawbacks? Further, considering that in the region in question the sugar seasons run from August to September and not towards the end of the autumn, the author has been led to adopt as an indication in the choice of material for selection the method of analysis of the parent plants in August-Septemher, whereas for the preservation of the selected beets until the following spring, the method adopted is that of replanting in the ground, where the beets very soon take root and put forth new and abundant foliage.

CHAP. IV. — SHOULD *Beta vulgaris* BE INCLUDED AMONG PLANTS WHICH ARE INCAPABLE OF SELF FERTILISATION? — The author remarks, firstly, that until recent years no-one had raised doubts on this question (DARWIN, for example, who however included *Beta vulgais* among those plants that were more vigorous when cross-fertilised, not only did not include the species among those which are incapable of self fertilisation, but even declared it to be very self fertile). The author then discusses the thesis put forward in 1916 by H. B. SHAW, according to which there is in the beet an almost absolute self-incompatibility; and after having quoted a number of his observations on the subject, before and after 1915, he concludes by stating that if SHAW's assertion is not completely acceptable, it nevertheless deserves the greatest consideration. However this may be, fresh research is required to clear up several points which still remain obscure.

CHAP. V. — ON DEGENERATION DUE TO INBREEDING (INZUCHT). — This is one of the most largely developed chapters.

The author first quotes the opinion of those who have previously dealt with the question (C. DARWIN, 1876; W. BARTOS, 1897; E. LAURENT, 1902; H. BRIEM, 1904; K. ANDRLIK and his collaborators, 1908-1909; H. VOGELSANG, 1895-1907; H. METTE, 1908; SESSOUX, 1909; G. FRÖLICH, 1911; H. CRON, 1912; B. KAJANUS, 1913; TRITSCHLER, 1913-1915; E. SCHRIBAUX, 1915; E. BAUR, 1919; M. GAILLOT, 1919). Then he correlates the supposed or real degeneration due to self-fertilisation in the beet with the real or supposed degeneration in other plants (maize, rye, etc.) and with the degeneration due to inbreeding in animals. The author wished to approach the question by following the greatest possible number of descendants derived from isolated individuals. In a single year (1913), 1300 beets were placed under isolators, and 1850 in 1915. With so considerable a number of descendants it was logical to expect very large and very complex returns. Among other things, the experimentor denies absolutely the appearence among the descendants of white sugar beets of plants with coloured skin and pulp; every time that such plants appeared they were only the result of an unsuspected cross with the pollen of ordinary beets fructifying more or less distantly, which is easy to prove experimentally. However, the process of self fertilisation entails the weakening or decrease of vigour of the descendants (degeneration in the Darwinian sense); the fresh vigour infused into the degenerated type by intercrossing between different descendants returns then to the ordinary phenomena of heretosis (stimulation by heterozygosis).

No biologist nor anyone who had dealt with genetics had recorded, up to the present, specific observations on beet; this seems strange when one considers that vigour appears in hybrids with a not unusual frequency. The phenomenon is much more apparent and much more remarkable when the produce of the first generation comes from a cross between a cultivated beet and a wild plant.

CHAP. VI. — THE SUGAR BEET AND THE PROBLEM OF SELECTION. — The progress made since the time when MARGGRAF's first analyses indicated a content of 5 % of sugar is scarcely believable. In fact if numerous data since the time of MARGGRAF and ACHARD up to the present are co-ordinated, graphs can be made which brilliantly demonstrate cumulative action in the direction of selection itself for the partisans of the efficacy of selection, and that with the simultaneous movements of whole groups according to GOLDSCHMIDT's scheme. Unless this question should here be asked: — Has selection itself caused the *change in act* of one or several hereditary units, or has it *simply isolated* or brought out pre-existing attributes?

It must be remembered that, from 1811 onwards, ACHARD recorded beets containing 18 % of sugar and that in 1856 VILMORIN recorded specimens with 21 %. Now, if at that time much more rapid methods of individual analysis had been employed, so that some tens of thousands of roots might have been examined in place of some hundreds, would not beets have been found with still higher percentages? If since the beginning of the past century the present system of individual selection and of purifying races had been known, could the jump of averages towards the highest content have been immediate or nearly so? The question has a great analogy with that raised regarding SMITH's work of selection on maize and CASTLE's on *Mus rattus*.

However this may be, everyone is now agreed that the sugar beet has at present reached a degree of perfection which allows it to be included in the category of pure or fixed races, for which individual selection cannot have the importance and the scope which it had when an impure race or a disordered mixture of types was treated. " To invoke, meanwhile, the prodigious success obtained and recorded by Louis Vilmorin in order to praise, as certain writers still do, the virtues of genealogical selection, is to enunciate a problem without understanding the significance and the scope of the values on which an opinion is to be expressed. But if, nevertheless, to follow the descendants of each individual means the possibility of discovering by chance eventual inmost tendencies to deviations from type, and consequently to improve even simple micromutations, this principle always remains the sole weapon which the selector can use. "

The author next deals with the problem of the " sudden degradation " and the " return to the primitive type " of the beet in the absence of selection. After having quoted the opinion of several writers who have studied the question (de Vries, Blaringhem, Costantin, Harris, Pritchard, Saillard, etc.) and determined the sugar-producing faculty of the beet, the author remarks that if selection has simply acted, as is probable, in bringing about the gradual elimination, from the original mixture, of types of less value (" selection by elimination "), the selector has separated one from another, by means of chemical processes, the components of a hybrid and consequently has unconsciously practised mendelism before Mendel himself. If this is so, to speak of " return to the primitive form " would be nonsense. Lastly, the author propounds the terms of the problem of selection relatively to the environment in which he must work, and the observations he has made lead him to admit above all the necessity of following the descendants of the greatest possible number of subjects (over 5000 direct or collateral descendants were followed from 1912 to 1919). Then he draws attention to a new method to which he had recourse with the object of purifying races that were decidedly heterogenous and feebly self-fertile ; it related to the fructification by pairs of subjects derived from the same parent plant presenting similar morphological characters and chemical attributes. The results obtained were interesting and it was possible to separate forms, detached from type that were specially recessive and deviating.

Chap. VII-XII. — Technical conclusions and researches — For a preliminary summary estimation of the beets of each descendant, the experimentor has used, for many years, utilising working on several tens of thousands of roots, the method of immersing the beets in solutions of sodium chloride. This system, as is known, was abandoned by selectors when the processes of direct determination of the sugar was introduced and became general (1860-1865) ; but if the method is in reality insufficient and empirical, it ought still to be considered valuable and reasonable when it is supplemented by the determination of saccharose, by the polarimeter. But the use of the refractometer, by which the density of the juice can be determined with a very small quantity of pulp (a few decigrams), deprives the system of immersion in sugar or saline solution of a great deal of its scope in application.

The problem of preserving the parent beets during the winter has also attracted the attention of the author, in view of the fact that during winters in the region very heavy losses (up to 90 %) had been recorded for beets kept in ordinary silos. After a series of comparative tests, a process was discovered which enabled 95 % of the roots to be saved up to the time of replanting in spring. Regarding the survival of beets at low temperatures, the author has not yet arrived at any exact conclusion, and it has not been possible to confirm W. BARTOS' statement, namely that beets whose young leaves have reddish petioles are more resistant than those whose central leaves have no trace of anthocyanin.

The author next describes a type of isolator which he adopted and in which the fabric portion is replaced by a sheet of glass which enables the beets to profit by sufficient direct rays during the whole period of isolation; this caused an improvement in the glomerules. Regarding cellular isolation ("Häuschen-Isolierung"), the author is in complete agreement with H. B. SHAW and admits that this means does not prevent contamination with external pollen (special experiments undertaken since 1913, in which coloured and uncoloured plants were obtained, prove this clearly); but as the objects which are interesting to follow are chiefly to separate, even roughly, the descendants and to follow the greatest possible number, the method of cellular isolation, carried out opportunely, retains its full value.

A short final chapter deals with the question of shortening the vegetative period (method of the *Wintersteckling*e) in accordance with the directive ideas of G. RATH (1911).

899 - **White Sugar Mangold Selection at the Ruakura Farm of Instruction, New Zealand.** — GREEN, A. W., in *The New Zealand Journal of Agriculture*, Vol. XXII, No. 5, p. 289, fig. 1. Wellington, May 20, 1921.

The selection of white sugar mangold, commenced by W. S. HILL at Moumahaki several years ago, has been continued without interruption, and an excellent crop of this strain was secured at Ruakura last year, the yield being over 73 tons per acre. A further selection of 100 roots has since been made, and 25 lb. of seed has been harvested.

During the farm school held at Ruakura last July (1920) the visiting farmers were much impressed by the weight and quality of this crop and sacks of selected mangolds were distributed to 27 of them for seed production on their own farms.

900 - **Study of Bud variations in the Eureka Lemon With a View to Citrus-Fruit Improvemente in California.** — SHAMEL A. D., SCOTT, L. B., POMEROY, C. S. and DYER C. L. in *United States Department of Agriculture, Bulletin No.* 813, pp. 1-88 figs. 22. Washington D. C. June 25, 1920.

OBJECT OF INVESTIGATIONS. — To determine the frequency and importance of bud variations in lemon trees of the Eureka variety; to ascertain the commercial value of the various strains originating from bud variations; to discover methods for isolating the best and eliminating the inferior strains through bud selection; to introduce and establish a system of individual tree records with the idea of obtaining reliable supplies of material for propagation purposes or improvement of orchards.

INDIVIDUAL TREE RECORDS. — For each tree: 1) Number; consisting of 3 parts corresponding to the block in which the tree occurs, the number of rows, and the number of trees in the row; 2) Picking; fruit were picked when reaching a certain fixed size, as determined with the aid of special metal rings; 3) Assorting; fruit at each picking were classed in 3 grades: *a*) Green, in which both the light and dark green fruits were included; of commercial value; *b*) Tree-ripe, usually small with thin rinds, an abundance of juice lacking in acidity; *c*) Cull, extremely coarse, and malformed rendering them unfit for the market.

For each grade one fruit was selected and examined to count the seeds and note the characteristics. All the data are registered on special forms for recording the weight and number of the fruit. These forms serve as a register with reference to yield. Other special records are kept with regard to the total annual yield.

NEW VARIETIES ARISING FROM BUD VARIATIONS — Descriptions are given of new strains arising from bud variations.

1) *Eureka Strain* (Open-Productive strain, name adopted because of the habit of growth and the heavy production). — Production is continued and regular throughout the year and thus of commercial value; leaves rounded or elliptical and distinctly contrasting with the sharply pointed ones of some other other strains; fruits oblong in shape, medium in size, thin rind, abundance of juice, solid, with about 7 seeds.

2) *Small-open Strain.* — Fruits more nearly globular and smaller.

3) *Shade-tree Strain.* — Thus named owing to its spreading habit of growth with luxuriant foliage, very pointed, which at certain seasons when there is a scarcity of fruits give them an aspect of ornamental trees. The main crop is borne during the autumn and winter. Fruits are oblong, rind very thick, pulp coarse and juice not abundant. Another characteristic of this strain is the large number of imperfect flowers produced with pistils rudimentary or absent, pollen scarce or with low vitality, etc.

The production and quality of the fruit of *Shade-tree* is very much less than those of Eureka On the average 25 % of these trees were found in the orchards.

4) *Dense-Unproductive Strain.* — Inferior as regards quantity and quality of fruits produced. In some ways they resemble the trees of the preceding strain; vigorous vegetative development; imperfect flowers, etc. It is distinguished by its erect and dense habit of growth and by its smaller size.

5) *Pear Shape Strain.* — Characteristics similar to *Eureka* but distinguished by the shape of the fruits which render them of inferior commercial value. The trees are finely branched and abundant presenting a bush like shape; the leaves are small and ovate in shape.

6) *Dense-productive Strain* — Differs from Eureka mainly in habit of growth, branches and density of foliage, and the fruits are largely covered by the protecting foliage and are thus less likely to suffer from climatic

injury or sunburn. This condition makes up in part for the somewhat lower production of the trees of this strain. The fruits are oblong, medium in size, pulp tender, juice abundant and very acid.

7) *Variegated Strain.* — The bark is variegated with stripes of green and straw colour; the leaves are almost entirely green or white, or white and green intermingled; the fruits have also a striped appearance, alternate green and white areas. This variegation combined with the rough texture of the fruits and thin rinds which are liable to split, makes them of inferior commercial value. Certain growers use the trees for ornamental purposes.

8) *Sporting Strain.* — These plants are interesting from the point of view of their multiple and simultaneous bud variations, which produce typical fruits of all the strains under observation and other new types.

TABLE I. — *Forms for field use for making individual tree records from lemon trees.*

A) *Front of sheet*

	Fruits								Seeds		
	Green grade		Tree-ripe		Cull		Total		Green grade	Tree-ripe grade	Cull grade
	weight	Number	weight	Number	weight	Number	weight	Number			
34-75-15	lb. oz. . . *tare* . . .										
34-75-16	lb. oz. . . *tare* . . .										
34-75-17	lb. oz. . . *tare* . . .										
34-75-18	lb. oz. . . *tare* . . .										

B) *Back of sheet*

Variable fruits	Tree				Variable fruits	Tree			
	15	16	17	18		15	16	17	18
Collared					Ridged, collared and protruding				
Collared and protruding .					Sunken section				
Protruding blossom end .					Creased.				
Bottle shape					Split.				
Raised section					Abnormal shape.				
Raised ridge					Brown-rot				
Ridged and collared. . .					Sunburn				
Ridged and protruding .									

This strain is very undesirable, not only owing to the mixture of fruits, but also from the danger of trees being used as sources of budwood.

A certain number of individual trees belonging to each of these strains were under special observation for a 6-year period: July 1911 to June 1917.

A detailed statement relative to this period is reported in special tables with reference monthly to the number and weight of fruits belonging to the various categories: *a*) Green; *b*) Tree-ripe; *c*) Cull.

The foregoing table shows the trees of the Eureka strain not only to be of superior quality but also more productive; this is the only strain of real commercial value.

Thus, the selection *ad lib.* of parent trees as sources of bud wood either from vegetative strains, or from the largest trees with the idea that the size of the tree was correlated with production, or yet again from sucker bud wood, all contributed to the diminution in commercial value of the orchards. On the contrary, bud wood and parent trees should both be selected from strains with typical fruits and the danger of propagating the undesirable strains will thus be largely eliminated. Only fruit-bearing bud wood from superior plant trees selected on the basis of their individual production records should be used for propagation or top-working. Table II refers to the average annual crop of several of the important strains.

TABLE II. — *Average annual production per tree during period* 1911-1917.

Number of Trees	Description of trees	Average annual production per tree							
		Total crop		Green grade		Tree-ripe grade		Cull grade	
		Weight lb.	Number	Weight lb.	Number	Weight lb.	Number	Weight lb.	Number
10	Highest producing (all Eureka strain)	299.45	1341	201.71	754	63.83	292	33.92	295
76	Eureka	230.03	1051	144.63	541	57.20	263	28.20	247
2	Dense productive	217.55	980	155.67	576	39.85	183	22.03	220
20	Small Open	179.86	808	119.07	445	41.43	188	19.36	174
2	Pear shape	153.72	721	87.69	328	52.80	264	13.23	128
17	Shade-tree	144.79	597	117.17	426	18.00	79	9.62	90
10	Dense unproductive	96.09	405	73.42	266	14.93	66	7.74	71
10	Lowest producing (irrespective of strain)	89.44	379	68.46	250	13.48	60	7.50	68

901 - **Bud Variations in the Lisbon Lemon and their Importance from the Propagation Standpoint.** — SHAMEL, A. D., SCOTT, L. B., POMEROY, C. S., and DYER, C. L., in *United States, Department of Agriculture, Bulletin* No. 815, pp. 1-70, figs. 14. Washington, D. C., June, 1921.

The same general methods of keeping records in the studies of the Lisbon variety were followed as those governing work with the Eureka lemon. The article in question gives a description of the following distinct strains:

1) Lisbon (standard); 2) Open, named according to habit of growth

3) Dense unproductive; 4) Bull; vigorous vegetative growth with large sharply pointed leaves, coarse fruits with thick rinds and little juice; 5) Variegated; 6) Sporting.

Only the first two strains are of commercial value, and should therefore be worked for propagation purposes and for top working and the reestablishment of orchards.

902 - **International Congress for the Control of Seeds.** — See No. 883 of this *Review*.

903 - **Varieties of Oats and Barley which have given the Best Results in Iceland.** See No. 881 of this *Review*.

904 - **Spur Feterita a New and Distinct Variety with Superior Grain Producing Qualities in Texas, U. S.** — CONNER, A. B., and DICKSON R. E., in *Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas. Division of Agronomy, Bulletin* No. 275, pp. 1-28, figs. 14, Tables 11, Brazos County, Texas, Feb. 1921.

Spur feterita is the name given to a new and distinct variety of grain sorghum developed by plant breeding work by the Texas Agricultural Experiment Station at Sub-station No. 7, Spur, Texas. The unimproved feterita commonly grown, and introduced into the United States from Sudan in 1909 has proved its worth as a forage plant, but the new variety under discussion possesses a stem with a diameter 27 % larger than that of the former and is less liable to lodging and stands well in the field, even after ripening. It is about 1 ft. less tall than the unimproved feterita, but is somewhat taller than milo or even kafir. The seed head is compact, and well filled with seed at the base giving in 1919 as an average % grain per head 76.68 % compared wth 72.62 unimproved variety; 74.29 kafir and 76.38 milo.

Although the growing season required varies with the time of planting, the average time required for Spur feterita is about 1 week more than for unimproved feterita and 3 days more than for milo. The average length of the growing period in 1919 is recorded as 97.

A series of plantings of Spur feterita, unimproved feterita, milo and kafir were made for the purpose of determining the relative grain yields of these 4 crops. The results from each of the 8 different plantings together with the average results in grain yield are shown in the following table.

Yield of threshed grain in bushels per acre 1919.

Variety name	April 15	May 3	May 15	June 2	June 16	July 2	July 15	Aug. 1	Average
Spur Feterita . .	66.44	63.94	68.00	71.72	49.39	41.59	22.13	14.93	**50.14**
Unimproved Feterita	60.48	57.18	61.77	58.85	56.85	39.95	21.10	8.29	**45.55**
Milo.	55.18	49.23	40.26	37.82	33.11	25.35	23.48	—	**33.05**
Kafir	51.02	45.60	37.02	35.26	33.95	31.06	—	—	**29.28**

Spur feterita has been grown in a comparative way with unimproved feterita at different Substations and the former was found to produce yields superior in quantity to the latter by approximately:— 8 bus. per acre at Spur, 2 3/4 bus. at Lubbock, and 1 1/4 bus. at Temple.

The results at Spur, Texas, are shown as follows:

Table II — *Yield in bushels per acre — General tests.*

	1916	1917	1918 *	1919	1920	Average
Spur Feterita . . .	31.52	22 39	—	50.14	49 29	**30.67**
Unimproved feterita.	21 84	14 32	—	45 55	31 18	**22.78**

* Crop failure on account of extreme drought

In the appendix, tables are given showing the monthly distribution of rainfall for the years referred to in the bulletin at Spur, Lubbock and Temple.

905 – **Treatment of Potato Sets and Arguments For and Against Cutting and Planting Whole.** — I. Cooley, E. W., (Agricultural Extension Dept. International Harvester Co. U. S. A. To Cut or Not to Cut Seed Potatoes in *The Potato Magazine*, Vol 3, No. 11, pp. 8-9, figs. 3, Mount Morris Illinois. May 1921. — II. Schribaux, E, Expériences a entreprendre sur la fragmentation des plants de pomme de terre in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 7, No. 4, Paris, Jan 26, 1921. — III. Taylor, W. H., Treatment of Potato Sets in New Zealand in *The New Zealand Journal of Agriculture*, Vol. XXII, No. 4, pp. 227-228. Wellington. April 20, 1921. — IV. Tice C., The Potato in British Columbia Whole versus Cut seed in *Department of Agriculture, Soils and Crop Division, Province of British Columbia, Bulletin* No. 86, pp 24-27, Victoria B. C. 1921.

Some growers declare that seed potatoes should be cut lengthways so that each piece will contain a part of the seed end of the potato, confident in the fact that the seed end sprouts sooner than the stem end or any other part of the potato and that the sprouts will be stronger and the yield larger. Others assert that the seed end should be cut off and thrown away as they consider that instead of sending out one or more strong vigorous shoots, the seed end will produce a number of small, weak ones Then again, some of the most successful potato growers plant nothing but the whole potatoes (I). Experiments made in various countries are therefore well worth consideration in order to come to some more definite conclusion as to the best method to adopt.

I. — In the United States as a result of observation and experiments conducted in Maryland, Michigan, Colorado, etc. it was concluded that most of the eyes on a potato have equal value for seed proposes, and at Michigan Agricultural College Farm it was demonstrated that the stem end piece bore as vigorous sprouts when separated from the seed ends as the seed ends themselves, and when all other conditions were equal, the individual hill yields were also approximately the same. While it is true that the size of the seed piece is more important than the number of eyes, the experiments seemed to indicate that each seed piece should contain at last 2 eyes

A number of seed potatoes from high yielding hills were cut so as to give pieces of approximately the same weight but with varying numbers of eyes Twenty one pieces containing 1 eye per piece showed 61 % germination: 4 pieces with 1½ eyes per piece showed 75 %, 20 pieces with 2 eyes per piece, 4 with 2½ eyes per piece and 7 with 3 eyes per piece, showed 100 % germination The average quantity of cut potatoes used amounted to 10 bushels per acre, but experiments conducted on 360 farms in the State of New York showed that the yield was from 85 to 100 bus more per acre when 18 bus. of seed were planted than when 10 bus were used.

II. — M SCHRIBAUX draws attention to the evident disadvantages connected with cutting sets, and then proceeds to indicate the advisable methods to adopt in order to compare the growth and yield to be obtained from cutting or planting whole, in consideration of the fact that at the Académie d'Agriculture d'Angers, information has been received recommending the cutting method both from the economical standpoint and as regards yield.

As regards the disadvantages, emphasis is laid on the fact that certain varieties (e g Richters' Imperator) when cut, are liable to rot This is, however, an exception and there is no reason to exaggerate the physiological dangers attached to cutting which can to a large extent be lessened and even eliminated. Care should be taken to plant only sets which have been exposed to the air for several days. Secondly, extra labour is involved in the cutting process. There is also a risk of waste through drying which applies also to the period following planting, as cut sets are less resistant to drought, defective cultural operations, etc than whole sets. Even under favourable conditions, success is at present uncertain and the author considers that this is due to the lack of knowledge concerning *a*) the advisable average weight of the cut sets; *b*) the best system of planting to employ.

The author suggests the following plan and but considers that unless the greatest care is taken to observe the details, it should not be attempted, seeing that it is the relative and not the absolute yield which it is desired to determine.

Whole sets		Cut sets					
Distance apart	Number of plants per sq yd	*Small* about 3½ oz, each with 2 eyes		*Medium* about 7 oz		*Large* about 1 oz	
		Distance apart	No of plants per sq yd	Distance apart	No of plants per sq yd	Distance apart	No of plants per sq yd
cm		cm		cm		cm	
50×40	5	50×14	14	50×20	10	50×25	8
50×50	4	50×18	12	50×30	7	50×33	6
50×60	3	50×25	8	50×40	5	50×50	4

[965]

The cutting of small sets above recommended is the method adopted with success by M. Maisonneuve at Angers, who after having removed a good third of the tuber where there are few eyes, cuts the remainder into 6 or 8 parts according to the number of eyes. As regards the large sets, M Schribaux recommends a similar removal of the lower inferior part of the tuber and cutting vertically the remainder into equal parts.

With reference to planting, the author remarks that the cut sets should be planted less deeply than the whole sets: about 3 to 4 cm. deep for the small, 4 to 5 cm. for the medium and 5 to 3 cm. for the large.

At harvest time, note should be made of the failures, the average number of shoots per plant, the yield per plot and per clump; the average weight of tubers and the proportion of large, medium and small. During these experiments, it is particularly important to note carefully all circumstances which tend to influence the quality of the yield in one way or another.

III. — In New Zealand, it has been proved by growers that potatoes may be roughly divided into two classes viz. round varieties on which the eyes are nearly all active at the same time, and kidney shaped (occasional rounds) that have a decided rounded end. If the former be planted with all the buds intact, a large proportion of them will grow into shoots The latter behave differently. One, two or three buds start before the others, and if nothing happens to destroy them they will produce a plant; the remaining eyes will remain dormant. If the tops of these shoots are injured by frost, they make fresh growth lower down. This naturally results in a reduction in the crop, but the latter may still be profitable. A second frost may occur which will entirely destroy the first tops. Other buds, that probably have already broken but not made much headway, then break through and may produce a crop just sufficient to pay costs. This explains why no disbudding is done. The seed tubers are not cut as that would cause decay, and the second set of buds would not be able to continue growth.

The common belief that all the eyes on a set will produce shoots, and that disbudding is necessary to prevent an overplus of shoots which would give small potatoes is, therefore, contradicted.

IV. — Experiments conducted in British Columbia support the claim made by M. Schribaux that in districts where the land is wet or poorly drained, whole potatoes are preferable to cut sets, since the latter rot easily. Also cut sets are more subject to disease, and sprout later. However, the percentage of marketable potatoes has been found in this case to be smaller when whole sets are planted than with cut sets.

When cut sets are used, a 2-oz. piece has been usually found the best. This statement is fully borne out in an experiment carried out by Dr. Zavitz at Guelph. Sets were planted for 5 years weighing $^1/_{16}$ oz, $^1/_8$ oz., $^1/_4$ oz., 1 oz., and 2 oz.; one eye was left in a piece and the pieces planted 1 ft. apart in the rows. There was a variation in yield from 47.5 bushels to 173 9 bus. for 2 oz., of seed Subtracting the amount of seed used, the former gave 46.2 bus. and the latter 132.7 bus. The system of cutting out the eyes of the set is not recommended, as the author considers there is not enough plant food present to support the young shoot till it develops a root. System two eyes to a set is usually conceded as giving better results than even 1 or 3 eyes. Where a larger number of eyes are present the percentage of marketable tubers is greatly reduced; this was found especially true when the seed-end of the potato was planted although the potatoes thus obtained were earlier.

906 - **Varieties of Oats and Barley which have given the Best Results in Iceland.** — See No. 881 of this *Review.*

907 - **Alfalfa Culture in Argentine.** — SCASSO J. M (Agricultural Enquirer and Specialist in Forage Plants, Buenos Aires), in *The New Zealand Journal of Agriculture*, Vol. XXII No. 4, pp 217-220. Wellington, April 20, 1921.

Alfalfa adapts itself readily to the soil and Argentine climate, and its cultivation is greater than that of any other crop, the actual area under cultivation amounting to 7 619 000 hectares. In the years of ordinary rainfall 4 cuttings are made per year of 7000 kg. per hectare per cut (approximately 2 $^3/_4$ tons per acre) making a total of 28 000 kg. per hectare. In the neighbourhood of the large cities, in the Andine provinces and territories of the south, where there are large installations for irrigation purposes, irrigation is much used in the culture of alfalfa, and in these cases naturally the returns are always greater, as much as 6 or 8 cuttings per year of 9000 kg. per hectare per cutting being obtained; i. e 54 000 to 72 000 kg per year per hectare

The production of alfalfa seed is one of the principal resources of commercial agriculture in the Argentine. It is calculated that the proportion of seed utilised annually for the new sowings amounts to 80 %, the other 20 % being the product of other countries, principally Italy, France and the United States. In the case of alfalfa under irrigation, the production of seed is about 600 kg. per hectare It has been proved that the existence of colonies of bees in proximity to the alfalfa fields has resulted in the returns of seed being increased by as much as from 30 to 40 %.

There is a notable variation in the duration of alfalfa fields according to the regions in which the plant is cultivated.

The average duration of the fields in good production is from 12 to 15 years, but there are areas in which alfalfa fields of 30 years standing yield good returns, especially those under irrigation as in the territory of Rio Negro, the province of St. John and other parts. In the provinces of Cordoba (South) and St. Louis, the territory of La Pampa, etc. there are alfalfa fields not under irrigation which have existed for more than 25 years and these still produce abundant crops. This may be explained by the fact that the deep rooted system of the plant utilises the water that flows many metres deep in the soil.

The author gives details of the preparation of the land, methods of sowing and cultivation generally, and of the utility of alfalfa for pasture, hay making and ensilage. The use of fertilisers is not practised, neither is the use of inoculated soils and lime, found to be a necessary proceeding in Argentina, owing to the fact that the physo-chemical composition of the soils allows the normal development of alfalfa.

908 - **Cotton Growing in Natal: Records of Recent Trials.** — WILSON, W. B., in *The Farmer's Weekly*, Vol. XXI, No. 533, pp. 1178-1179, figs. 3. Bloemfontein, May 25, 1920.

In 1914, the Tobacco and Cotton Division of the Union Government set up an office for Natal to conduct co-operative experiments with the farmers and to study the conditions and means of re-introducing cotton growing with a view to establishing the industry on a permanent basis.

During the season 1914-15, 9 varieties of Upland cotton seed, amounting to 446 lb. were distributed to 21 experimental stations, situated chiefly in the New Hanover and Richmond districts of Natal and parts of Zululand. During the second season much better results were produced than in the first and in Weenen and Zululand the crops were very promising.

The results at the first mentioned place showed a yield of 960 lb of seed-cotton per acre, for the "King" var, and 718 lb. per acre for "Cleveland". As this was a very dry season, this establishes the drought resistant properties of these two types.

The following year the same growers planted an area of 46 ½ acres which gave an average yield of 1212 lb. per acre, and a proportionately larger profit was made over an increased acreage. Other growers at Amatikuha, Zululand, showed similar results both as regards increased acreage and price.

Over the whole of Natal, the increased production during recent years as shown by the official statistics and the Cotton Grower's Association, are as follows: 1915, 1110 lb., 1916, 4890 lb., 1917, 23 604 lb., 1918, 396 bales of approximately 250 lb. each; 1919, 843 bales, and 1920, 1418 bales (both of approximately 480 lb. each).

It is evident, therefore, that very rapid strides have been made the last few years. The really serious question affecting the cotton position is probably that of marketing the crop. In 1915 and 1916 the Government had control of the marketing, pooling the entire crop according to its respective grades and selling most of it overseas, distributing the money among the growers after the receipt of the account of sales. This resulted naturally in a very heavy delay before the grower received the amount due for his crop, but in the absence of local buyers, there was no other course open.

In 1917, the crop began to assume commercial proportions and the Government made other arrangements as regards ginning facilities, but the question of uniformity of staple demanded by the market, the best seed for planting, and how the grower is to be paid for the crop are still important questions which still remain to be determined.

As regards uniformity of staple, different varieties have been planted side by side for the purpose of testing the suitability of the respective varieties to South African conditions: the crops from these plots were ginned on the same machines. This resulted in cross fertilisation and mixing of seeds until uniformity of staple was very much lacking — a serious defect from the spinner's point of view. Also, the relatively heavy yields from the shorter staple varieties was an inducement to growers to plant these to a large extent, in spite of the fact that long staple is more in demand. The percentage of different length staple of the 1920 crop of cotton may be stated as follows:— full staple, 1 $^1/_8$ in., 39 %; medium staple, $^{15}/_{16}$ in. to 1 $^1/_{16}$ in., 32.28 %; short staple, $^7/_8$ in. or under, 28.12 %.

On account of lack of uniformity of staple and the large proportion of short fibres, the S. African cotton is at present very much in disfavour. This difficulty is, however, by no means insuperable, as has been shown in Uganda where a similar position prevailed in 1908. The Government there took into its own hands the matter of seed selection and distribution and as a consequence, Uganda cotton is now highly prized by spinners and commands an excellent price.

Up till now very little attention has been given to seed selection by Natal growers, but the Cotton Growers' Association intend if possible to obtain the support of the Government to establish a farm for the production and distribution of seed for the benefit of the industry.

Summing up the facts relative to cotton growing in Natal, the author states: — 1) that long-stapled American Upland varieties have proved to be the most suitable for the conditions while all attempts at ratooning or growing the cotton as a perennial, irrespective of the variety or class of cotton, have resulted in failure; 2) the cotton does best on the rich soils of the low hot valleys, and the best soils of the coastal belt, but not too near the sea and in exposed positions.

It has been proved conclusively that Natal cotton of good quality can be produced, but that satisfactory results are not to be obtained without careful and persistent labour. The industry can now be made permanent if studied closely and built up firmly step by step

909 – **Discovery of a Wild Cotton, *Bassia lanuginosa*, n. sp. in Western Queensland.**—White, C T (Government Botanist, in *Queensland Agricultural Journal*, Vol. XV, No 5, pp. 216-218, pl. 1. Brisbane, May, 1921.

Specimens of a wild cotton plant found by Pether on poor sandstone hills near the Mayne River, Western Queensland, were forwarded in 1921 for identification, to the Ministry of Agriculture.

On examination, the plant proved to belong to a species of *Bassia*, and one apparently new to science, the nearest allied plant known being *B. carnosa*, which occurs in a few coastal localities in Western Australia. The cotton surrounding the seed of the new species is, however, considerably longer than the last named species.

A description of the n. sp. designated by the name of *B. lanuginosa* is herewith given:

Small undershrub about 1 ft. high; numerous erect simple stems arising from a hard branching woody base; stems covered with a dense, long, floccose tomentum; leaves sessile, linear or the uppermost ones more or less ovate, lower ones about 2.5 cm. long and 2 mm. broad; uppermost ones 0.9 to 1.1 cm. long and 3.5 mm. broad, densely covered with long silky or cottony hairs; flowers sessile and solitary in each axil, but crowdded along the upper part of the stem, densely enveloped in long white silky-woolly hairs; fruiting perianth depressed; about 2 lines in diameter without wool, but over 1 in. in diameter with wool teased out, the 5 lobes enclosing the fruit and surrounded by a slightly raised horizontal ridge, but without appendages of any sort; stamens 5, styles 2, united to about the middle; pericarp about 2 mm. in diameter, depressed ovoid, membranous with a few long hairs.

The cotton ripens from the bottom of the stem upwards and falls away as it ripens. As far as it is known, PETHER considers that it would reach maturity in 3 months, but so long as the ground is kept moist, it would keep green, as it appears to grow and ripen much the same as the natural grasses. It will grow, however, where natural grasses would not grow owing to poor quality of soil and there is also no doubt that the plant is hardy.

It has been reported that this is the first example of a native fibre approaching true cotton that has been seen in Queensland, but that, owing to its short staple, its commercial value is doubtful, although it might be used as a substitute for kapok.

910 – **Notes on the Native Bamboos and Varieties introduced into Lower and Middle Belgian Congo.** — VANDERYST, R. P. H., in *Revue Générale Agronomique*, New Series, Year II, No. 2, pp. 47-64. Brussels, 1921.

The native bamboos in Lower and Middle Belgian Congo are scarce, and chiefly belong to the dwarf species, not exceeding 2 m. in height; the actual distribution is as yet unknown, but taken as a whole the value of these dwarf bamboos form the scientific standpoint is negligible.

As regards the varieties imported into the Belgian Congo, the author classifies the species according to the number of stamens and type of fruit, and gives their fundamental characteristics and distribution tendencies.

The following species are enumerated:— ARUNDINARIA: *A. alpina* K. Schum, *A. Simonii* Riv., *A. japonica*, Sieb. and Zucc. PHYLLOSTACHYS: *P. mitis* Riv., *P. aurea* Riv., *P. nigra* Munro, *P. violascens* Riv., *P. viridiglaucescens* Riv. EUBAMBUSEAE: *Atractocarpa olyriformis*, *Puelia Dewevrei* De Wild., *P. guluensis* var., *P. ciliata* Franch., *Gigantochloa maxima* Kurz., *Oxytenanthera abyssinica*, A. Rich. BAMBUSA: *B. macroculmis* Riv., *B. vulgaris* Schrad., *B. spinosa* Roxb., *Guaduella marantifolia*, *Dendrocalamus strictus* Nees., *Cephalostachyum pergracile* Munro, *Microcalamus* sp., *M. barbinoidis* Franch. and *Ochlandra travancorica*.

The author gives the principal morphological characteristics associated with bamboos in this country and their importance from an economical standpoint.

911 – **Experiments with Castor Oil Seed Conducted at Sabour, India.** — TAYLOR, C SOMERS (Agricultural Chemist, Bihar and Orissa), in *The Agricultural Journal of India*, Vol XVI, Pt. II. pp. 146-161, March 1921

Report of attempts made to determine whether by chemical selection it is possible to improve the race of *Ricinus communis* from the point of view of its oil-yielding properties.

Remarkable differences in oil-content of seed were observed from the different types obtained from various parts of Bihar, but this may have been due to the varying conditions under which the plants were grown, and fresh selections were therefore made from the highest and lowest yielders of the 1919 crop, which was grown under uniform conditions at Sabour. Fifteen parents of low oil content were taken, and 20 of high oil content. The mean of 11 good plots was 49.6 % for descendant of parents whose mean was 54.2 %. The mean of 10 well grown "low" plots was 48.6 % from parents whose mean was 42.5 %.

There appeared, therefore, to be strong indications that in the majority of cases the plants did not transmit a high or low oil-content for even one generation, but that in both cases the seed showed a mean oil-content, which lies somewhere about 49 %, when the plants are healthy, and a little lower when the reverse is the case. Out of the whole series, two appear to have kept pure as regards oil-content for more than one generation.

A plot has also been observed which shows a splitting up into different varieties which differ in oil-yielding as well as in ordinary botanical characters *viz.* F_1 green 50.9 %. Four distinct varieties, green A 51.8 %; green B 50.6 %; purple A 46.6 % and purple B 50.4 %; weight of seed 4, 12, ½ and ½ oz. respectively. Original analysis 54.7 % oil. Observations on these varieties will be continued.

Results generally may be taken to give a good comparison between different varieties, and afford a good idea of what could be obtained commercially by the modern method of extraction by solvents such as petroleum ether or carbon tetrachloride.

In order to examine how a small sample will indicate the composition of the main bulk, a number of samples were obtained from botanically pure, or nearly pure, varieties of "*bhadoi*" castor. The analysis of 15 samples from a bulk collection of one variety showed in 1920 a standard deviation from the mean of ± 1.04 %, the mean being 49,5 %. Other analyses made in 1921, taking selection from plant to plant in each of these fairly pure varieties, showed a standard deviation of ± 1.5 %, the mean varying from 47.6 % to 50.9 %. From these observations, the probable error in the oil determination of a single sample of any one variety may be calculated at about ± 1.0 %, of the weight of the seed. The "*rabi*" grown crop showed, however, a standard deviation of 2.0 % (mean 52.3 %), but this may be attributed to the effect of different conditions of growth which had a strongly marked effect on the seed obtained from each plant.

It appears probably that variations in agricultural treatment may possibly have more effect on the oil-yield of the crop than actual chemical selection. As the result, therefore, of a considerable amount of work, a few varieties have been selected which appear to be richer in oil than others, and maintain a mean oil-content greater than 49.5 % which may be taken as the mean of all the types tested here. The improvement is not as marked as was hoped. The greatest improvement observed above the general mean this year was just under 5 % in the case of spring sown *bhadoi*, while the autumn sown *rabi* only showed an improvement of about 3 %.

912 - **Cultivation of Coconut Palm in Porto-Rico.** — GONZÁLES, RIOS P., in the *Departamento de Agricultura y Trabajo, Estación Experimental Insular, Rio Piedras, P. R., Circular No.* 35, pp. 20, figs. 4. San Juan, P. R., Feb. 1921.

No exact data are available regarding the actual number of coconut palms in Porto Rico ; in 1917, according to data collected by the " Comisión de Alimentos," 6832 *cuerdas* (47 113 sq. m.) were planted with coconut palms, and about 10 million coconuts were exported. Porto-Rico coconuts are exported chiefly to the United States ; for export the nuts are freed from the fibrous part of the husk (" coir ") and packed in bags containing 75 to 100. The other producing countries — Ceylon, Java, East Africa, Philippines, etc. — export copra, that is, the fleshy part of the nut, dried in the sun or in ovens. In Porto-Rico there are 3 factories, 2 large and 1 small, for the extraction of coir which is used for making rope, brushes, matting, etc., or else as fuel in factories near the palm groves. The ash is very rich in potash ; some samples contain about 20 %.

Large palm groves grow along the coast of the island ; alluvial soils, by the side of streams, suit the coconut palm very well, but are rare in the island. Fine coconut palms, good producers, are also found on compact soils, but such soils can seldom be used for making plantations since the coconut palm likes mellow soils, moist and easily permeable by water.

The selection of nuts for planting is not generally practised, but the author urges that it should be ; he advises against making plantations with young palms bought in nurseries ; and recommends the selection of the finest nuts on the finest palms 12 to 25 years old (during that period they bear the most vigorous nuts for planting), the picking of these nuts when their fibre is dry or has commenced to dry, the cutting of at least one nut per palm, choosing only palms with nuts that have very thick flesh, rather round than elongated in form, the drying of the nuts selected for planting, spread on the ground in a shaded and aerated place. When planting, the tip of the nut should not be pointed downwards, as is generally done, but have an inclination of 45° ; in this way the layer of flesh which the roots have to traverse is thinner and the distance they have to grow before burying themselves in the soil is shorter.

Replanting can take place when the palm has reached a height of either 30 cm or a little more, or of 1 m. In the former case there is the advantage of being able to get out the roots with less risk of injury, but on the other hand there is the drawback that the stem is still feebly attached to the roots.

Final planting should be made at a spacing of at least 8.40 metres apart in squares ; very close planting is responsible for the low production of many of the Porto-Rico plantations. The trenches should be dug 3 months before planting and the ground should be manured if possible, and carefully kept clean between the palms ; the weeds pulled up should be spread on the ground round the stipes, at a distance of about 30 cm. from them in order to keep the soil moist.

During the first few years after planting, sugar cane, maize, cotton, tobacco, sweet potatoes, or preferably leguminous plants, kidney beans, horse beans, etc., can be grown between the lines. After the 4th year, livestock may be allowed to graze in the plantation.

When the plantation begins to bear, it should be carefully cleared of husks, dry leaves, etc., which should be heaped and burnt to destroy the insect pests which nest in them. The coconut palm lives for 75 to 100 years.

A mixture of fertilisers to be recommended is such as will provide 0.5 kg. of nitrogen + 0.25 kg. of phosphoric acid + 1 kg. of potash per palm. Experiments made since 1908 by the "Estación Experimental Federal" of Mayagüez (Porto Rico) have shown that an increased yield is obtained by applying a complete manuring, that is to say a mixture containing 8 % of phosphoric acid, 6 % of nitrogen, 12 % of potash. By the application of 4.5 kg. of this mixture per palm the crop of coconuts was increased by 30 %; by the application of 9 kg. of this mixture it was increased by 60 %. When the nitrogen and the potash were excluded from the mixture there was no increase; on taking away the phosphoric acid there was a limited increase.

DISEASES AND PESTS OF THE COCONUT PALM IN PORTO RICO. — They do not cause serious injury. Of insect pests, the mot feared is the "escarabajo" (*Strataegus quadrimaculatus*) which penetrates the stipes and ruptures it. It is controlled:— By catching it by hand; by burning the dry leaves and detritus in which it nests; by means of luminous traps; by insinuating a wire with a chisel point into the galleries, where it is not possible to catch it by hand, so as to penetrate it here and there; or else by blocking the galleries with a stopper of cotton wool soaked in carbon disulphide. The "gusano blanco del caculo" (*Phyllophaga* sp.) gnaws the leaves, especially those of the young palms.

The "queresas" (*Aspidiotus destructor* and *Vinsonia stellifera*) adhere to the leaves, from which they suck the sap, causing the leaves to turn yellow. They are controlled by emulsions of soap and paraffin.

Rats are also to be feared; the best means of preventing injury by them is by putting a band of tin or zinc round the stem.

The rotting of the terminal bud ("pudrición del cogollo") is not known at Porto Rico, though it is well known in the neighbouring islands of Cuba and Trinidad.

Finally the author gives information regarding the extraction of coir and suitable mechanical apparatus. According to him the Firm which sells the most complete apparatus for extracting and working up the fibre is the Fibre Machinery Co., 20, Bucklersbury, London, E. C.

913 - **Spanish Sage (*Salvia hispanica*) as an Oil-bearing Plant.**— *Boletín de Agricultura, Industria y Comercio de Guatemala, Organo de la Secretaria de Agricultura*, Year I, No. 1, pp. 21-22. Guatemala, Jan. 1921.

The seeds of the Spanish sage (*Salvia hispanica*; synonyms:— *S. polystacha* Ort., *S. Columaia* Benth.) are used in the preparation of certain beverages; if they are steeped in water for 12 hours they produce a great deal of mucilage, which is a very pleasant basis for cooling drinks. The use of these seeds as a source of oil is much less general, although it is remunerative to grow the plant for its oil, as it produces an abundance of seeds which contain 20 to 40 % of a drying oil very much valued in painting for the brilliancy which it gives to colours. This plant is so little exigent that it is almost a weed; it grows perfectly, even in poor soils where it so to say smothers all other plants. It is ripe 4 months after sowing; if sown very thick the crop may attain 12 to 15 quintals per hectare If it is sown on fertile soil, in lines and ridged up (which is very beneficial to the plant), much more abundant crops can be obtained.

Salvia hispanica, apparently originating in California, is cultivated in various parts of Mexico. Seeds from that region analysed by Prof. Mario CALVINO, Director of the "Estación agricola esperimental" of Santiago de las Vegas (Cuba), contained about 7 % of moisture and from 23 to 40 % of oil (extracted with petroleum ether). The oil obtained by pressing the ground seeds is very clear, of a light green-yellow colour, and bleaches spontaneously in the light; it resembles linseed oil not only in odour, but also in all its other characters.

914 – **Cultivation of (*Rhus succedanea* in Tonkin.** See No. 950 of this *Review*.

915 – **Notes on Methods of Cultivation of Camphor throughout the World.** — See No. 951 of this *Review*.

916 – **Commercial Possibilities of the Nipa Palm (*Nipa fruticans*).** — I. Sugar and Alcohol from the Nipa Palm in *Bulletin No. 3, Forestry Department British North. Borneo* reproduced in *The Journal of the Board of Agriculture of British Guiana*, New Series, Vol. XI No. 1 pp. 51. Demerara, Jan. 1921. — II. Commercial Possibilities of the Nipa Palm, in *Journal of the Royal Society of Arts*. Vol. LXIX, No. 3570. pp. 367. London, April 22, 1921.

I-II. — It is stated that the Nipa Palm (*Nipa fruticans*) is one of the very few tropical plants which occur in pure stands over extensive areas in Borneo. In common with many other palms, its sap contains sugar, and laboratory experiments concluded at the Bureau of Science, Manila, indicate that production of sugar from nipa palm sap would be a commercial success. According to these experiments, it is estimated that there would be at least 12 % of recoverable sugar in the sap, and the average annual yield of 4000 gallons of sap per acre of nipa under management should produce about 4000 lb. of sugar.

Although the production of sugar from nipa sap is still in the experimental stage, according to the U.S. Consul General at Singapore, the manufacture of alcohol from the same source is a well established industry. For many years the natives of the Philippines have been producing a low grade distillate averaging about 25 % alcohol, which has been used as a beverage. Lately the crude stills which produced this distillate have largely been replaced by modern distilleries, of which 75 were in operation in 1913. These produced 2 500 000 gallons of distilled spirits. Over 98 % of this production is diluted and used for beverages, and the balance utilised as fuel for lamps, stoves and motors.

The cost of the distillate as at present produced in the Philippines is difficult to determine, as operations are scattered, manufacturing processes are not well controlled and the cost of collection of the sap is not uniform. In a compact and well managed area, it should be possible to collect and deliver to the distillery at a cost of 50 or 75 cents per 100 gall.; and this quantity of sap should produce between 6 and 7 gall. of alcohol which places the cost of raw material at 8 to 12 cents per gall. of alcohol. The plant needed for distillation is estimated at $15 000 for a 500 gallon per day unit. Including wages, fuel, and interest on investment, the estimated cost to manufacture should not exceed 10 cents per gall. of alcohol, and the total cost of production should not exceed 20 cents per gallon. Experts who have operated in the Philippines maintain that a well organised plant near well managed and concentrated areas of the palm can produce at a cost of 14 cents or less per gallon.

The nipa palm grows in dense formation on tidal areas throughout all the eastern tropics. Very extensive areas are to be found in Borneo and the British North Borneo Government estimates that at least 300 000 acres exist at very accessible points throughout their territory. One block of 57 000 acres has already been surveyed on the west coast and certainly another 100 000 acres can be reached within 4 hours by launch from Sanadakan on the east coast and yet another 100 000 acres near Tawan, on the east coast, but farther south.

917 - **The Use of Tea Flowers for Infusing.**— *Boletin de Agricultura, Industria y Comercio de Guatemala, Organo de la Secretaria de Agricultura*, Year, I, pp. 23. Guatemala, Jan. 1921.

The infusion of the flowers of tea is much less known than the infusion of the leaves, although richer than the latter in aroma and equal to it in all other qualities. In view of the facility for fraud in the leaf-tea trade, the flowers offer several advantages compared with the leaves, e. g. easy plucking, no injury to the bush, much greater difficulty in adulteration.

As the teabush flowers very abundantly, it would be profitable to work it for its flowers. Tea made from the flowers could be sold at a higher price than that made from the leaves, for not only is it more aromatic but also sweeter and contains less thein. Recently tea made from the flowers, which up to date had been reserved for the exclusive use of rich people in the principal producing countries, and was not exported, has begun to be imported into Europe.

Tea does well where coffee does well; its growth in Guatemala, with a view to harvesting the flowers, is therefore recommended.

918 - **Cultivation of Saffron (*Crocus sativus*) in Macedonia.**— *Journal of the Royal Society of Arts*, Vol. LXIX, No. 3577. pp. 487-488. London, June 10, 1921.

The autumnal crocus (*Crocus sativus*) is a native of southern Europe, and western Asia, and is extensively cultivated in Spain, France, Italy and Cashmere. The saffron derived from this plant, requires about 4000 of the dried orange-coloured stigmas to make 1 oz.

According to the report by the U. S. Vice-Consul at Salonica, the 3 villages Goblitza, Vanitza and Spourta, in the district of Cozani (Macedonia), at one time produced a crop estimated at 1500 okes (1 oke = 2.82 lb.); but cereal planting has been more profitable lately, consequently the crop is now only from 600 to 800 okes per year, a reduction of abot 50 %.

In planting, the bulbs are set in the ground 10 in. apart and after 6 or 7 years are taken up and separated, each original bulb yielding a new bulb for every year since planting. A feature of the growing of saffron is the possibility of using the same field for an early crop of some cereal which does not require deep planting. For a good harvest it is necessary that the weather be dry.

After the harvest the saffron is packed in a crude state in matting trunks containing about 50 kilos (1 kilo = 2.2046 lb.) each, and transported to Verria, where they are reloaded on waggons and carried to Salonica. Here they undergo a refining process and are then packed and shipped; chiefly to France and to a certain extent to England.

The product is used in various ways, as a medicine, in the manufacture of cordials and liqueurs; as a colouring matter (the red pistils are utilised in producing a red dye); and in parts of Europe as a flavouring and colouring ingredient in cooking.

Cultivators in Macedonia predict that in a few years time the plant will be more highly valued than at present as a result of the improved methods now being introduced.

919 - **Aniseed (*Illicium verum*) Cultivation and Distillation, and Production in Tonking, Indo-China.** – JEANCARD P. in *La Parfumerie Moderne*, Year XIV, No.4, pp 73-75. Lyon, April, 1921.

The author states that the aniseed (*Illicium verum* Hook.) is cultivated in the district north east of Tonking, Indo-China and in Long Tcheou (Chinese province of Kouang-Si). It is localised in the cantons of Lang-Son, That-Khé, Dond-Dang, Vinh-Rat, Halung, and Na-Chaur at an altitude of 200 to 300 m. It is propagated by seed, and transplanting takes place at the end of 3 years. The inflorescence appears the 7th year, but it is only after 10 years that the first fruit is produced, which contains the well known oil, utilised by the Chinese for medicinal purposes, as an anti-toxin.

The average yield per tree (10 to 20 years old) is from 30 to 35 kg.; after this age has been attained, 40 to 45 kg. is counted upon, and the irregularity of yield can only be attributed to lack of cultivation and to insect attack.

Since the cultivation of this plant has come under European control, it is considered probable that the trees will become more vigorous, will fruit earlier and well, and with much more regularity.

As regards distillation, the Chinese alembic is employed which differs distinctly in construction from the ordinary recognised form of alembic. The author gives illustrations and a detailed description of this " Alembic Tho ". The whole operation last 48 hours (continuous) and 180 kg. of fruit is treated each time. The average yield of oil per 180 kg. amounts to 6 or 7 kg., i. e. 3 to 4 %. The value of the oil thus obtained is estimated according to the congealing capacity as regards temperature. This is measured by means of the BECKMANN method.

The author quotes the exports from Indo-China between the years 1897, 1912 and 1918; the maximum was attained in 1913, viz. 230 000 kg. However, these figures do not in any way indicate the total yield, as a considerable quantity is utilised anually in Indo-China and China, etc., The average price obtained on the French market before the war was between 10 and 15 fcs. per kg.

Aniseed oil obtained principally from Russia before the war was the sole product competing with anethol, and seeing that this has not been put on the market since 1914, there are evidently possibilities of development of the aniseed industry in Indo-China.

920 - **The Variation in Composition of the Rhizomes of Bracken *(Pteris aquilina)*, and Food Values** (1). — HENDRICK J., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information* No. 4, pp. 157-166. London, 1921.

An investigation was started in the spring of 1918 with the intention of taking samples of the rhizomes of bracken at intervals throughout the year to ascertain the variation which took place in their composition with the season, and the best time of harvesting them from the food and starch-production point of view. Amongst others, samples were taken in April from two points on the Experimental Farm of the North of Scotland College of Agriculture in Craibstone, and when analysed, the percentage of nitrogen varied extraordinarily, although the moisture and dry matter content were almost identical. With the development of the fronds, the store of nitrogen in the rhizomes diminished seriously and the percentage in both sets of samples reached a minimum in July when the frond reaches its maximum development. After this, the nitrogen increased again and soon reached a maximum. This has a bearing on the important economic problem of the best time to cut bracken when it is desired to clear land.

The maximum percentage of nitrogen in the dry matter was reached in August in both cases but the outstanding difference between the 2 sets of samples is the radical difference between the percentage of nitrogen all through the season. The soluble carbohydrates and fibre also vary in a somewhat similar fashion. Neither the ash nor the ether extract show special features calling for comment. Why then should the nitrogen content exhibit such a remarkable difference? No botanical differences were found and both appeared to be normal *Pteris aquilina*.

Analyses were also made of the fronds at different periods during summer and autumn, but except for the differences in nitrogen and moistures, no other striking dissimilarity was found between the 2 sets of samples. The composition was found to be as follows:

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(1) See also "Bracken Rhizomes and their Food Value". *Transactions of the Highlands Agricultural Society of Scotland*, 1919, XXXI, 5th series, pp. 227-246. (*Author's note.*

TABLE I. — *Composition of Bracken Rhizomes.*

No. and date of the taking samples	1 April 1	2 June 7	3 July 18	4 Aug. 21	5 Sept. 25	6 Oct. 28	7 Nov. 30	8 Dec. 27	9 Feb. 4	10 March. 8	Average
A. *Samples*											
Moisture	74.60 %	78.71 %	77.32 %	72.89 %	61 93 %	71.66 %	69.87 %	62.61 %	70.15 %	69.24 %	71.10 %
Composition of Dry Matter:											
Ether Extract	1.02 %	0.80 %	1 21 %	0.70 %	0.68 %	0.70 %	0.73 %	0.74 %	0.74 %	0.84 %	0.82 %
*Albuminoids	8.62	4.73	1.84	6.23	6.24	1.87	1.88	2.86	1.82	5.69	4.18
Solubles Carboidrates	65.52	58.78	57.01	67.96	68.68	71.82	68.44	71.67	72.25	62.79	66.49
Fibre	17.52	27.36	27.44	18.11	18.79	18.80	22.28	20.00	19.46	26.17	21.59
Ash	7.32	8.33	12.50	7.00	5.61	6.81	6.67	4.73	5.73	4.51	6.92
	100.00	100.00	100.00	100.00	100.00*	100.00	100.00	100.00	100.00	100.00	100.00
*Containing Total nitrogen	1.37	0.76	0.29	0.99	0.99	0.30	0.30	0 45	0.29	0.91	0.66
» Protein nitrogen	0.87	0.70	0.29	0.88	0 91	0.22	0.23	0 37	0.22	0.75	0.54
* » Siliceous matter	3 86	3.68	9.24	2.21	2.34	3.88	3.17	1.71	2.75	1.46	3.43
Ash less siliceous matter	3.46	4.65	3.26	4.79	3.27	2.93	3.50	3.02	2.98	3 05	3.49
B. *Samples*											
Moisture	74.72 %	78.18 %	73.35 %	74.83 %	65.01 %	66 65 %	68.02 %	61.45 %	68.03 %	68.68 %	70.19 %
Composition of Dry Matter:											
Ether Extract	0.05 %	1.33 %	0.72 %	1 07 %	0.88 %	0 71 %	0.75 %	0.78 %	0.75 %	0.80 %	0.87 %
*Albuminoids	21.19	18.39	7.54	13.66	11.80	11.75	12.13	12.32	11.78	12.38	13 29
Soluble Carbohydrates	48.30	43.62	50.12	58.86	66.92	58.43	61.39	60.97	59.73	56.62	56.51
Fibre	20.26	28.23	27.71	19.30	14.40	18.74	19.35	18 90	18.89	21.07	20.68
Ash	9.30	8.13	13.91	7.11	6.00	10.37	6.38	7.03	8.85	9.13	8.65
	100.00	100.00	100.00	100 00	100 00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing Total nitrogen	3.39	2.94	1.21	2.18	1.88	1.88	1.94	1.97	1.87	1.97	2.12
» Protein nitrogen	2.88	2.40	1.16	1.94	1.51	1.74	1.79	1 82	1.72	1 66	1.86
» Siliceous matter	5.42	4.25	10.00	2.10	3.57	6.95	3.28	4.05	5.41	5.77	5.08
Ash less siliceous matter	3.88	4.18	3.91	5.01	2.43	3.42	3.10	2.98	3.44	3.36	3.57

TABLE II. — *Composition of Bracken Fronds.*

	A Samples				*B* Samples			
	1	2	3	4	1	2	3	4
Moisture	May 30	June 18	Sept. 25	Oct. 28	May 9	June 18	Sept. 25	Oct. 28
	% 90.39	% 69.55	% 62.90	% 19.20	% 90.33	% 74.27	% 70.27	% 18.42
Composition of Dry Matter								
Ether extract	2.39	3.14	2.53	1.69	2.94	4.33	2.45	1.97
*Albuminoids . . .	27.73	15.59	3.37	3.40	25 15	21.58	7.56	6.74
Soluble carbo-hydrates	41.09	50.35	52.38	44.34	44.76	46.29	48.62	42.46
Fibre	13.17	24.50	34.66	44.34	15.86	20.66	33.97	42.88
*Ash	15.62	6.42	7.06	4.65	11.29	7.14	7.40	5.95
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*Containing total nitrogen . .	4.44	2.48	0.54	0.54	3.99	3.46	1.21	1.07
Containing protein nitrogen. .	3.69	2.43	0.38	0.45	3.58	3.42	0.90	0.91
Containing siliceous matter . .	0.73	0.52	2.83	2.69	1.08	0.43	1.85	2.30

Samples of the soil were taken from both places to see if they exhibited any remarkable differences in nitrogen content, or otherwise, which might throw light on the existing differences in the bracken. Both soils are typical sour, moorish soils, and the results of a partial analysis % showed respectively for A and B ; loss on ignition (humus, etc.) 42.65 and 26.95; total nitrogen 0.55 and 0.57; nitrogen as nitrate, absent in both cases; nitrogen as ammonia 0.001 and 0.001 ; lime requirement 1.53 and 1.30. There is therefore no noticeable difference as regards nitrogen content. It would require approximately 15.3 tons of carbonate of lime to neutralise " A " and 13.0 tons to neutralise " B ".

The difference in situation is the only real difference which the author suggests as the cause in variation in composition of plants taken from the two places. (" A " on the open hillside and " B " in a well sheltered hollow).

This, however, hardly appears to be a satisfactory explanation for so remarkable a difference in nitrogen content.

921 – **Forage Root Crops successful in Ireland.** — See No. 881 of this *Review*.

922 – **Pineapple Problems in Florida and the Improvement of Pineapple Soil.** — GOODWIN, R. C. and WARREN, A., in *The Florida Grower*, Vol. XXIII, No. 24, pp. 4-5, figs 6. Tampa, Fla.. June 11. 1921.

Pineapples have been successfully grown commercially on the East coast of Florida for over 30 years. Up till 1915 the industry brought in about 1 million dollars annually to St Lucie County, where the plants were resistant to diseases and pests, but after that time many of the fields have become unprofitable owing to the lack of potash fertiliser, an essential element in the cultivation of pineapples which invariably renders them more resistant to cold.

By applying ammoniates without potash, the plants appeared to become tender and very susceptible to injury from frost. The grower was reduced to the use of blood and bone, tankage, etc. owing to the exorbitant price of potash, and the severe frosts in 1917 followed by a dry year in 1918 led the grower to despair of success.

In the meantime, however, the Agricultural Department at Washington and the Experiment Station at Gainesville were carrying on experiments in plant selection, fumigation, soil sterilisation, disinfection of soil and plants etc., and pineapples planted in 1919 show sign of giving a crop this season (1921).

Plots of ground on old fields have been steamed, others treated with formaldehyde or carbon bisulphide. The experiments are conducted to prove or disprove many theories that have been put forward, and the information obtained will always be of value to growers in Florida.

Although at present local pineapple plants are very scarce, plants will be imported and it is hoped to build up the industry again within a few years time.

In the summer of 1919, experiments were started by SHERBAKOFF in St Lucie County on the A. F. Hoofnagle Estate to discover to what extent the nematode is responsible for the so-called pineapple wilt which has appeared prevalent of late years. Soil was forthwith sterilised with steam, carbon disulphide and formaldehyde, and other experiments were also conducted to show the value of selecting strong healthy slips and also of the fumigation of slips before planting.

Cuban slips gave by far the best results, but as these are difficult to obtain in Florida, it is advised to select with much care the local slips.

The plots where the slips were fumigated with hydrocyanic gas, at the rate of 2 oz. of sodium cyanide to 100 cub. ft. showed superiority over those with the non-treated slips.

With regard to soil sterilisation, it is as yet too soon to draw any definite conclusion, but the plots so far present a very favourable appearance and the plants are growing well

Among further salient points that have been brought out by the experiments the following may be mentioned: —

(1) Restoration of humus in the soil by the growing of some plant resistant to nematode. So far the best results have been obtained with Natal grass (*Tricholaena rosea = Panicum Teneriffae*) (1) and more especially so where it has been allowed to grow undisturbed for 2 or 3 years and only ploughed under before the planting out of pineapples.

2) Necessity of a definite system of rotation. After the 4th or 5th crop of fruit, the field should be planted with some cover crop for one or two years to be ploughed under. This can be so arranged as to maintain a uniform acreage in pineapple each successive year.

Experiments are still in progress in St. Lucie Co. by the Federal

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(1) See *R*. Sept. 1916, No. 979 (*Ed*)

[922]

Department, the State Experiment Station, in conjunction with the growers, with a view to ascertaining directly the causes of pineapple wilt.

923 - **Vine Growing and Wine Making in the Province of Mendoza, Argentina.** — CRANNA C. in *The Industrie italiane illustrate*, Year 4, No 50, pp. 14-16, 6 phot., 3 pl., Milan, Dec. 1920.

The author reviews the agricultural development in the Province of Mendoza due to European immigration, from 1885 to the present time.

In 1885, the time when immigration began, the Province had 96 929 inhabitants; it possessed 54 million francs (at par) in heritable wealth and 97 289 hectares of cultivated land, of which 3500 were under vines, and produced 15 000 hectolitres of wine. It exported chiefly to Chile.

According to the census of 1914, the population has increased to 277 535 inhabitants, the heritable wealth to 1400 million francs, of which about 1000 is inverted in landed property. The following Table indicates the agricultural progress made: —

Kind of crop	Area in thousands of hectares in 1914	Products in 1914	Value of products in millions of francs at par	
			in 1914	in 1885
Meadows	85	Hay and pasture	5	11,60
		Cattle and their products	2	
Cereals	45	Cereals	8	1 55
Vegetables and kitchen garden plant	18	Vegetables and kitchen garden plants		
Vine	67	Wine 45 million hectolitres	180	0.85
		Table grapes 5000 met tons	0.5	
Fruit trees	9	Fruits, fresh, dried, preserved	3	1.00
Various	15	Various	3	
			201,5	*15.00*

The vine therefore furnishes the principal coefficient of agricultural development in Mendoza. In 1885 the area under vines was barely 3 % of the cultivated area, while now it exceeds 25 %; in 1885, wine barely reached 7 % of the value of the total production and 2 % of the exports, but at the present time it represent 85 % of the former and 95 % of the latter.

The climate of Mendoza is arid, with 200 mm. of rain annually; the agricultural progress in due to irrigation. The irrigated area, which was 172 000 hectares in 1885, is now more than 625 000 ha. Before 1905 the wine was made by empirical methods; it is now made by good trained wine makers in large establishments which produce up to 350 000 hectolitres of wine a year. The wine-making industry represents altogether a capital of 300 millions francs or less than ¼ of the entire wealth, and it provides for the greater part of the public expenses.

The vineyards belong mostly to Argentine citizens; but $^4/_5$ of the planting and cultivation of the vines is done by Italian immigrants (" contrattisti ") who work by the piece. In 1885, unirrigated vines produced less than 7 quintals of grapes per hectare, but now irrigated vines produce on an average 110 and yields of 320 quintals are not uncommon. The author thinks therefore that the world record of vine production is held by the Province of Mendoza.

924 - **The Importance of the Selection of Cuttings in the Renewal of Vineyards.** — GABOTTO L., in *Il Coltivatore*, Vol. 67, No 16, pp 490-493. Casale Monferrato, June 10, 1921.

The author emphasises the risks connoted by want of care in the selection of cuttings for replanting vineyards attacked by phylloxera. The cuttings of nurserymen are generally, taken here and there in old vineyards without much attention to their parentage and healthiness. The old age of the vines may relate to the stock or to the individual. As the reproduction of the vine has been effected for a very long time by cuttings, it is reasonable to think that the present individuals all belong to varieties which, coming from stocks which are old, are from a biological standpoint, inferior. When these plants, which have in them the defect of coming from a old and worn out organism, are attacked by a disease the results can only be lamentable. Several phenomena which are attributed to a so-called " want of affinity " or a " want of adaptation " owe their origin solely to the congenital old age of the cuttings.

As it is not posible to ascertain the age of the stocks, there is an advantage in taking cuttings from young plants of 3 to 5 years, and particularly from new vines grafted on American stocks. The author recommends the methodical working of cuttings, supplemented by grafts; every nurseryman should watch the success of plantations made with the material which he has supplied, so that he may be able to have recourse for his subsequent supply of cuttings to young vines which have given the best results, choosing among them individual vines that are most commendable for their qualities of affinity, adaptation and production.

925 - **The Timbers of the Ivory Coast from the Industrial and Commercial Standpoint.** — *Gouvernement général de l'Afrique Occidentale Française, Les bois de la Côte d'Ivoire au point de vue industriel et commercial*, 32 pp. pamphlet. Paris, Emile Larose (Publisher), 1920.

France imported before the war about 2 700 000 cubic metres of timber per annum. She now finds herself obliged still to further increase her consumption and the total purchase of timber which she has to make outside France may be estimated at 1 milliard francs per annum. National interests require that these purchases should be made as for as possible in French Colonies which can supply the stocks required by the country. The Ivory Coast Colony offers its timbers which are known, classified, and as good as European timbers. The timbers of the Ivory Coast can replace notably: —

1) The poplar, " grisard ", and tulip tree of America.

2) The pines and firs of France, Northern Europe, Austria and America.

3) The oaks of French and foreign origin, and teak.

4) The beech, plane and hornbeam.

5) The elm, ash and acacia.

They answer the following purposes:—

1) Light furniture, boxes, panelling and interior work.

2) Frame work and joinery.

3) Building, house joinery, frame work, piles, beams, railway material, ship building.

4) Turnery, brush making, paving blocks, tool handles, harness making, chair making.

5) Carriage building, wheelwrights work (naves, fellies, spokes), turnery.

The timbers of the Ivory Coast also include large quantities of kinds used for high class joinery and furniture (mahogany, etc.).

All these timbers come from an immense forest situated along the Atlantic covering an area which is about half that of the Scandinavian forests and greater than that of the French forests. Several rivers flow through it and enter the sea or navigable lagoons. The railway from Grand Bassam to Bonaké traverses its whole width. The difficulties of shipment due to the bar have been remedied by constructing two wharfs at Grand Bassam, which is fourteen days from French ports. There are important forestry businesses, and several sawmills cut up and export the timber. But there still remains on the Ivory Coast $^9/_{10}$ of the forest to be granted in concessions. Large businesses to be successful should:—

1) Make a serious preliminary inspection.

2) Be capable of dealing with all the species which are found mixed up in a tropical forest not under management and requiring it.

3) Invent mechanical means as perfect as possible with a view to reducing human labour to the lowest limit.

4) Study the most economical conditions of transport by land and by water.

It is further very desirable that, in view of the world crisis resulting from the scarcity of wood pulp, the manufacture of pulp or chemical semi-pulp should be studied on the spot by specialists. To sum up, the French home market ought to be widely opened to the direct export of timber from the Ivory Coast, for it is anticipated that within three years from 100 000 to 200 000 cubic metres of timber will be exported from the Colony in place of 52 000 tons in 1913.

A list numbered from 1 to 22, indicates the timbers utilisable in large quantities for the reconstruction of houses destroyed by the war, and including altogether 4 to 50 % of the average stock of the Ivory Coast; a second list, from 31 to 46, indicates the timbers utilisable in small quantities composing about 20 % of the stock.

The results of tests made with the following timber are also republished:— *Entandro phragima* sp.; *Canarium occidentale; Bingeria africana;*

Mitragyna macrophylla; Trichilia Cedrela; Terminalia ivorensis; Chlorophora excelsa; Parkia agboensis; Dumoria Heckeli; Cola proteiformis; Napaga bingervillensis; Farinarium, sp.; *Erythrophleum guineense; Haematostaphis Bartezi; Lophira procera; Pynaerkia occidentalis.*.

LIVE STOCK AND BREEDING

926 – **An Attempt to Induce the Hereditary Transmission of Dourine** (1). — NATTAN-LARRIER, in the *Bulletin de la Société de Pathologie Exotique,* Meeting of May 11, 1921, Vol. XIV, No. 5, pp. 273-277. Paris, May 1921.

Experiments made with female rats and mice with a view to deciding whether the dourine trypanosome, which easily passes through normal mucous membranes (1), can traverse the placental tissue without difficulty, and whether the disease can be produced by *Trypanosoma equiperdum.* Several female rats were inoculated in the peritoneum. After the young were born; some of their blood, taken with every precaution by puncturing the heart, was injected into the peritoneum of a mouse. In most cases the liver and spleen of the same young mice were pounded up and emulsified in a physiological salt solution, and afterwards also injected into the peritoneum of a mouse.

The experiments proved that neither in the case of the mouse, nor in that of the rat, did the dourine trypanosome pass from the mother to the fœtus. Although dourine was thus never transmitted by hereditary contagion, the disease contracted by the mother frequently caused the death of the young mice. In one of the experiments, 1 out of 5 died; in another, all succumbed except one, while in a third experiment, none of the young were alive at the time of birth. As M. LAVERAN had shown that kids born of goats suffering from surra, or debab, *Tr. gambiense, Tr. congolense,* were not immune, even if the mothers had been immunised, the author investigated whether the kids of goats infected with *Tr. equiperdum* could contract the disease. He found that none of them were immune, and even when suckled by a dam actually suffering from the disease, kids acquired no power of resistance to it.

927 – **Note on a Disease of the Horse, Enzootic Haemoglobinuria, in German Austria.** — WIRT (Vorstand der Lehrkanzel für interne Medizin in Wien, in *Der Pferdezüchter,* Year I, No. 7, Part 23. Graz, June 15, 1921.

This disease first appeared in Upper Austria, afterwards in Styria, and has recently broken out in Carinthia. It is known provisionally under the name of "enzootic haemoglobinuria". After the manifestation of certain indeterminate premonitory symptoms, such as fatigue after light work and slight colic, different groups of muscles become swollen and paralysed, and the urine is brownish-red in colour. The animals are frequently unable to masticate and swallow their food. In some cases, the accentuated heart weakness observed in this disease is especially dangerous; often 90 % of the infected animals succumb.

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(1) See *R.*, May, 1921, No. 519, and *R.*, Aug., 1921, No. 826. (*Ed.*)

The malady chiefly attaks foals and young horses, although older animals are sometimes affected. From bacteriological investigation, it would appear that it is an infectious disease that attacks the nerve centres, and especially the spinal marrow. It was possible to cultivate a certain species of bacterium (streptococcus) from the spinal marrow of horses that have died from the illness. In the opinion of veterinary surgeons, it seems that the bacterium is introduced into the organism of the horse by means of fodder, especially spoiled hay. Hitherto no case of contagion has been observed.

If the animals are properly treated, as soon as the first symptoms appear, it is said that they can frequently be saved. The best prophylactic measure is always to give horses hay that is perfectly sound.

928 - **The Course Run by Camel-Surra in Ponies, Buffaloes and other Animals when Naturally Contracted and Artificially Inoculated.** — CROSS H. E. in *Agricultural Research Institute, Pusa Bulletin*, No. 98. pp. 1-19 and No 99, pp 1-19 Calcutta, 1921.

I. EXPERIMENTS ON CAMELS. — The course run by surra, and still more the probability of curing it, being still much under discussion, the author carried out experiments for the purpose of deciding these questions. He selected 11 army camels which had contracted the disease naturally, and 5 other camels, in which it had been induced artificially by inoculation with 1 cc. of infected blood from a camel.

The animals were kept under the most favourable conditions, and never worked. The results of the examination of their blood and the details of the paroxysms are given in numerous tables.

The following Table (pag. 1165) gives a summary of the conditions of the naturally and artificially infected camels respectively.

These data would seem to show that the duration of the life of camels infected with surra depends largely upon their age, so that it is very probable that the diseased animals when once they are over 6 years of age, and when they are worked, never recover. Whether those that become infected very young, recover, remains to be ascertained.

The paroxysms are for more frequent in the earlier than in the later stages of the disease, when diarrhoea often sets in. In many cases, swelling and suppuration of the inguinal glands are also to be seen. Mange produces very rapid loss of condition in surra-infected animals. When the camels are stall-fed they often feed well during the paroxysms, but if out browsing, they do not browse well, and do not go from tree to tree like camels in normal health. Very often oedema of the belly and legs is observed in camels suffering from surra.

II. EXPERIMENTS ON PONIES BUFFALOES AND OTHER ANIMALS. — In the course of investigations into surra among camels, it has often been found, that in spite of the large number of infected camels and the many *tabanidae*, there were practically no cases of surra among the ponies and mules kept in close proximity to camels.

Experiments were made on ponies, buffaloes, dogs, goats, sheep, rabbits and guinea-pigs, all of which were inoculated with the blood of camels

Age of animals when the disease was diagnosed	Under observation			Results
	years	months	days	
6 years	4	11	20	Died
6 »	5	3	5	Alive, condition fair.
7 »	5	3	5	Alive, condition very fair.
8 »	2	0	28	Died.
8 »	2	9	1	»
9 »	2	0	16	»
9 »	4	6	11	»
9 »	1	11	5	»
10 »	2	6	3	»
10 »	2	3	21	»
11	1	8	12	»
18 »	0	0	18	Died 18 days after inoculation.
2 1/2 months . . .	2	8	4	Alive, condition fair
1 year	4	3	11	» » »
1 »	4	3	11	» » »
1 »	4	3	11	» » »

suffering from surra. The author's opinion that ponies and mules infected with surra did not show the symptoms generally observed in camels affected by this disease, was completely confirmed.

The results of the experiments made in different species of animals, and a summary of the experimental data contined in the numerous tables, are as follows:

1) *Ponies.* — These animals, when inoculated with camel surra, often do not lose condition, and do not always die from gradual emaciation. If they are not worked, their condition may even improve, and they may live for some years. In some cases, especially during the last phases of the disease, the intervals between the paroxysms can be very long sometimes more than a year. Occasionally the hindlegs become paralysed.

2) *Buffaloes.* — There were no fatal cases amongst these animals as a result of experimental inoculation with camel surra; only a few trypanosomes were seen in the blood of buffaloes thus treated. Experiments made on rabbits and guinea-pigs showed that the blood of the buffaloes was infective and therefore buffaloes can act as a dangerous reservoir of surra.

3) *Dogs.* — These animals, when inoculated, manifested very little resistance to the disease, and succumbed, within the relatively short time of 2 months. They became emaciated and often developed opacity of the cornea.

4) *Goats.* — The inoculated animals did not die. Trypanosomes were very rarely to be found. In the blood of some goats which were inoculated experimentally, trypasonomes were seen 107 days after inoculation.

5) *Sheep.* — All the inoculated sheep died. Trypanosomes could seldom be discovered, nevertheless the blood was infective. The animals gradually lost flesh and finally succumbed. As centres of infection, goats

and sheep are not so dangerous as buffaloes, because they are rarely attacked by *tabanidae.*

Guinea-pigs and rabbits proved very susceptible to camel surra, and all of them died in from 17 to 180 days after having been experimentally inoculated with blood taken from infected camels.

929 – **Fowl Spirochaetosis in Doukkala, Morocco** (1).— Delanoi, P., in the *Bulletin de la Société de Pathologie Exotique*, vol. XVI, No 6 Meeting of June 8, 1921, pp 316-320 Paris June 1921

Since 1915, the author had suspected the presence of fowl spirochaetosis in Doukkala, and in 1920, he found spirochaetes in the blood of two chickens and of one young hen. In the last case, treatment with novarseno-benzol, rapidly proved the efficacy of this remedy against the disease. Experimental inoculation of 2 ducks and 2 geese in the wing-vein with 0.5 cc. of infected blood (containing a fair number of parasites) mixed with a citrated physiological solution showed that the goose and duck can contract a serious and rapidly fatal disease from an intravenous injection of infected blood.

There are two chief clinical types of the natural disease; an acute form, in which death ensues very quickly (the natives say that very frequently their fowls die suddenly while laying); and a sub-acute or chronic form with more or less complete paralysis, or rather paresis, of the lower limbs.

Very probably a benign form also exists with few or none of the external symptoms of the disease. The agent transmitting spirochaetosis is the fowl-tick (*Argus persicus* Fisher), locally known as the " black flea " The larvae are especially numerous in the summer, and made it impossible to keep fowls in hen-houses or enclosures, so that the only thing to be done is to imitate the natives and leave the birds at liberty.

Fowls are probably not the only birds that are naturally attacked by spirochaetosis, for although the author has been unable to find spirochaetes in the blood of infected ducks and geese that have not been inoculated, he thinks it is present, for a gosling 4 months old and weighing 8 to 10 kg., which had been ill for 20 days, and was suffering from complete paraplegia, was entirely cured in a few hours by the injection of 0.135 gm. of novarsenobenzol.

930 – **Nutritive Exchanges of Animals as a Function of Body Weight.** — Lapique L in *Comptes Rendus de l'Académie des Sciences*, Vol 192, No 24, pp 1526-1529 Paris. June 13, 1921.

Charles Richet, in his researches, which have rendered classic the law of proportionality between nutritive exchanges and body surface, remarked that oxen of 600 kg. in weight, and goldfinches weighing 21 gm. are not subject to this law, for they give figures that are too high as compared with those obtained in the case of animals of average weight. In previous experiments, the author · systematically · determined maintenance rations, at different temperatures, for small birds of different sizes, from pigeons to Bengal finches. The data thus obtained for the small homeotherms, together with the author's figures, are represented by logarithmic coordinates.

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(1) The presence of fowl spirochaetosis in Morocco was recorded by H Vemu, *Bulletin de la Société de Pathologie Exotique*, vol. XI, p 261. See also *R.*, June, 1920, No 668 (*Ed.*)

The author's experiments show that the smaller the animal the greater is the variation. Further, it has been found, that in the case of several animals of different size the exchanges re-calculated per surface unit when set down on the same coordinates, intersect, the smaller animals being above the larger, when the temperature is low, and below them when it is high. All the curves tend towards a minimum corresponding to the different temperatures ; the smaller the size of the animals, the more nearly do these temperatures approach the correct one, but the height of these minima is visibly the same, irrespective of the size of the species. It is at the surrounding temperature, which varies with each species, when the loss of heat occasioned by physical conditions is equal to the heat evolved by the actual life processes, that the law of surface holds good from one end of the scale to the other. If on the other hand, a single external temperature is assumed for all species, it is clear that the law is masked by the differences in thermogenetic latitude which allows an addition to be made to the initial expenditure, in order to counterbalance the loss of heat.

It thus appears that the *law of surfaces* can no longer be explained by the need of heat; it is based upon some deeper fact of general physiology which has not yet been determined.

931 - **Correlation Between the Size and the Digestibility of a Ration.** — HONCAMP F., and KOCH, E. (Mitteilung der landw. Versuchsstation Rostock in M.), in *Die Landwirstschaftlichen Versuchstationen*, Vol. 96, Nos. 1 and 2, pp 45-120, Numerous Tables. Berlin, March, 1920.

HENNEBERG, STOHMANN and WOLFF had already doubted the existence of any important influence exerted by the size of a hay ration upon the digestibility coefficient. KELLNER, on the other hand, having fed a mixture of roughage and concentrates to oxen, observed that the digestibility of the ration decreased as the quantity increased.

Experiments carried out in America, by JORDAN and HALL on cows and sheep, gave contradictory results, whereas KATAYAMA and also SCHNEIDEWAND observed that pigs digested best the protein contained in the smallest ration.

As the results hitherto obtained were at variance, on June 1, 1914, the authors began a series of experiments on sheep, to determine the possible correlation existing between the size and digestibility of a ration, when the fodder was the same, both in the case of a ration composed wholly of bulky fodder, and in that of one containing roughage as well as concentrates.

In the 1 st series of experiments, which was divided into 4 experimental periods of 10 days separated by intervals of 8 days, 3 sheep were fed a daily ration of 600, 900, 1200, and 600 gm. respectively, of the same clover hay: the author obtained for the 2 animals and the different sized rations, average variations not exceeding the usual limit of experimental error, except in the case of crude cellulose, of which the digestibility coefficient in the largest ration was 6.6 % lower than that of the smallest.

In a 2nd series of experiments carried out under the same conditions as the preceding, but with a ration composed of clover-hay, gluten, soya-flour,potato-slices mixed with molasses and potato-flakes the digestibility coefficient of the largest' ration differed from that of the smalllest in the following degrees:— 2.7 % total organic matter; 2.2 % protein ; 1.7 % nitrogen-free extract; 6.5 % pentosan; 7.6 % crude fibre; and + 8.6 % ether extract (crude fats), the only positive difference.

In another series of experiments with 2 young sheep, the rations fed consisted of clover hay, dry potatoes, rice and gluten, and only differed from the preceding ration in containing a larger proportion of carbohydrates, especially of the soluble varieties. With this ration, the reduction of digestibility was greater than in the 2nd series of experiments.

The authors do not think that the variations in the digestibility of the albumen can depend upon the differences in the intensity of intestinal decomposition, seeing that, in the experiment, the difference between ingested and evacuated matter was allowed for. Nevertheless, they have carefully observed the organic exchanges of nitrogen and sulphur under their various forms, taking as a basis the view of ABDERHALDEN. According to the latter, it would seem probable that under normal conditions all the esters combined with the sulphuric acid of the urine (phenol, indoxyl, skatoxyl) are derived from intestinal putrefaction, an opinion that is not shared by EMDEN, GLAESSNER and FOLIN.

The author conclude by stating that: 1) In the main, their researches on the secretion and decomposition of the sulphur compounds present in the urine of herbivora have not given the desired and expected results; 2) the results of these researches in no wise warrant the assumption that there is any correlation between the small depression of the albumen resulting from the increase in the ration, and a diminution of the decomposition of albuminoids in the intestine; 3) if the quantity of sulphuric esters in the urine were alone taken into consideration, an increase, rather then a decrease, in the decomposition would be observed as a result of the larger ration.

In fact, the increase in the ration produces a decrease in the solubility and digestibility of the crude fibre in the intestine, partly on account of the short time the unit weight of the food mass remains in the intestine (which also has the greatest effect when the ration consists exclusively of roughage), and partly because, if a ration is composed of a mixture with a high content of easily-soluble carbo-hydrates, the latter are first attacked by the bacteria of the intestine, and are rendered soluble and digestible, whereas the fibre is not touched; this depresses the digestibility of the crude cellulose forming the cell wall and hence of that of the albumen of the carbohydrate substances, etc. present within the wall.

In other experiments made upon 4 young sheep fed with a mixture of ordinary fodder in proportions varying in such a manner as to give rations differing as regards the amount of KELLNER's starch equivalents, the protein alone showed any practical difference in digestibility in the ration containing least starch equivalent.

The authors conclude that although it is true that an increase in a ration reduces its digestibility, yet it does so to such a slight extent as to be negligible in comparison with the larger errors made in calculating rations based on the mean value of the composition and digestibility of the fodders given (1).

932 - **Sunflower Silage Digestion Experiment with Cattle and Sheep** (2) — NEIDIG R. E., SNYDER, R. S, and HICKMAN, C. W., in *Journal of Agricultural Research*, vol. XX, No. 11, pp. 881-888, tables 6. Washington D. C., March 1, 1921.

Report of experiments carried out at the Idaho Agricultural Experiment Station in the United States with 3 Shorthorn cows, 3, 5 and 10 years old respectively, and with 3 yearling wethers, all pure-bred Shropshires; the silage used was made from sunflowers gathered when about 50 % were in bloom but when only a few seeds were in the dough stage.

The daily ration given was 50 lb., to cows and 2 lb. to sheep. During the 7 days digestion period, following on the preliminary feeding period lasting 10 days, daily records were secured of the amounts of silage fed, silage rejected and feces voided together with the daily weights of the animals. Chemical analyses were made of all composite samples.

Taking into account all the data recorded in the 5 tables the following coefficients of digestibility for cows and sheep were determined:

Coefficients of digestibility for cows and sheep.

	Dry substance	Crude protein	Crude fibre	Ether extract	Nitrogen free extract	Ash
	%	%	%	%	%	%
Cows (Average of 3)	51.7	47.8	37.4	73.7	56.3	26.6
Sheep (Average of 3)	58.8	54.4	46.7	77.4	69.8	38.5

These experiments show that the digestible nutrients contained in sunflowers compare favorably with those in mature and immature maize. The nutritive ratio is somewhat narrower in sunflower silage than in mature and immature maize silage. Sheep utilised slightly more nutrients in sunflower silage than cows under the same conditions.

Where both maize and sunflowers are grown under favorable conditions, the selection of a silage crop should depend upon comparative tonnage per acre and cost of harvesting.

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(1) In any case, this conclusion confirms the laws of the reduction in the digestibility and utilisation of fodders upon which Prof. JOVINO bases his calculation of the most economical ration See *R.*, May 1921, No. 551. (*Ed.*)

(2) See *R.* Oct 1920, No 1008. (*Ed.*)

933 - **Studies on the Hereditary Transmission of Trotting Capacity in French Trotters**(1) — VAN MELDERT, L', in the *Annales de Gembloux*, Year XXVII, Part 6, pp 135 155 Brussels, June, 1921

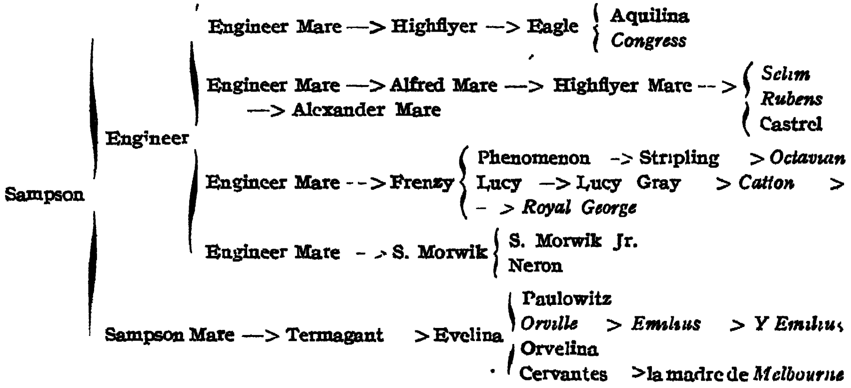
Report presented by VAN MELDERT at the last meeting of the Texas Horse Breeders' Association.

Struck by the fact that all the families of trotters had gradually disappeared in the United States in the great competition for speed, having retired from the field in favour of the progeny of "Sampson", the author began to study the history of the trotting-horse in France, and gives an account of the life of every stallion that has contributed to the improvement of the breed. His investigations show certain breeding theories to be entirely erroneous, that an exact knowledge of the pedigrees of the animals is an absolute necessity for progressive breeders, and that the registration of an animal in a Stud-Book is not sufficient guarantee of its performance as a sire.

The following is a summary of the report, which suggests new ideas concerning heredity and the results that can be attained in improving stock.

All the families of trotters in the United States have been submerged by the progeny of Hambletonian 10, in the great struggle for speed supremacy. The pedigree of Hambletonian 10 shows that this horse is descended five times from Messenger, the great-grandson of Sampson.

As a result of searching ont the descendants of "Sampson" amongst the ancestors of the trotters of France, the following lines have been discovered :


Sampson
Engineer
Engineer Mare —> Highflyer —> Eagle
Aquilina
Congress
Engineer Mare —> Alfred Mare —> Highflyer Mare -- >
—> Alexander Mare
Selim
Rubens
Castrel
Engineer Mare - - > Frenzy
Phenomenon -> Stripling > *Octavian*
Lucy —> Lucy Gray > *Catton* >
- > *Royal George*
Engineer Mare - > S. Morwik
S. Morwik Jr.
Neron
Sampson Mare —> Termagant > Evelina
Paulowitz
Orville > *Emilius* > *Y Emilius*
Orvelina
Cervantes >la madre de *Melbourne*

The great French trotters are the direct lineal descendants of *Selim*, *Rubens*, *Catton*, and *Orville*, which are the decendants of Sampson through their dams.

Sampson, although entered on the pure-blood stud-Book, was not pure-bred. His sire was apparently a draught horse. But as characters are transmitted equally well in the female and male line it is a mistake to class families solely according to the sire.

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(1) See *R*, May, 1921, No. 529. (*Ed.*)

Speed in trotting is a hereditary character. Only certain characters are transmitted which, according to MENDEL, may be either dominant or recessive. Inbreeding intensifies some hereditary characters.

It is erroneous to regard as axiomatic that:—

(a) *Like produces like*, for absolute likeness in shape and capacity is impossible, unless the parents are very nearly related.

(b) *Crossing is a means of improving the breed.* Crossing, on the contrary, destroys the results of improvement. The hybrids of different races never attain the acquired excellence of any race.

(c) *The product represents the sum of the qualities and defects of its ancestors.* Heredity can only affect certain characters, and these are either pure or mixed. The hybrid dominants are eliminated as selection progresses.

(d) *The product takes one half from its dam. and the other half from its sire.* This is a great mistake, for the offspring may inherit more from its dam than from its sire, or *vice versa*. There are thus no ½ blood, ¼ blood, or $^{1}/_{8}$ blood horses, nor horses of any fraction of blood.

Some pure-bred horses, very nearly related to Selim, Rubens, Orville and Catton, have turned out good trotters; of these we may mention:—

Ministère	9	times	descended	from Sampson
Plutus	7	»	»	from Sampson
Dollar	6	»	»	from Sampson
The Heir of Linne	5	»	»	from Sampson
Pace	5	»	»	from Sampson
Pédagogue	4	»	»	from Sampson
Fitz Pantaloon	4	»	»	from Sampson
Monarque	4	»	»	from Sampson

Apparently it has been possible to create a race of pure-bred trotters by breeding together the thorough-bred products closely related to Sampson, and showing an aptitude for trotting.

After a century of breeding, the French trotting horse (stallion) manifests a Sampson-heredity coefficient, that is to say, that each of the trotting-stallions are descended from Sampson the number of times given by his coefficient:

1900	Azur (Lillonet)	34
1901	Beaumanoir	62
1901	Bémécourt	56
1906	Grand maitre	96
1907	Helder	83
1908	Intermède	102
1910	Kalmouck	131
1915	Pro Patria	133
1915	Phenomenon	110
1917	Romanoff	141

The higher the Sampson heredity coefficient, the greater the value of the horse.

The trotters of France have 3 different origins :— (1) Most of the present trotters are descended from Sampson, and it may be predicted that, in a few years' time, the French trotter will be a pure Sampson ; (2) the Marshland Shale family ; (3) the Fucaway family.

The paternity of Sampson can be traced through all the generations of which he is the ancestor and the influence of Marshland Shales can be followed in French breeding stock.

As son as the Marshland Shales coefficient is higher than that of Sampson, the stallion ceases to be useful in the improving of the trotters.

	Coeficient of heredity		
	Sampson	Marshland Shales	Fucaway
1848 Ouvrier	—	1	2
1876 Lavater	5	2	—
1869 Noville	3	3	4
Noirmont	2	2	2
1873 Reynolds	5	1	—
Rollon	1	5	—
1874 Serpolet Rouan	4	2	3
Sobriquet	5	7	4
1876 Un	1	3	3

This offers an explanation of the question why certain fine stallions, such as Noville, Noirmont, Rollon, Serpolet Rouan, Sobriquet and Un were not successful at the Stud Station whereas Lavater and Reynolds from whose pedigree Fucaway 201 was absent, were excellent sires.

In France, horses with much of the blood of Fucaway 201 are as a rule roans; they are somewhat exclusive, and do not mate well with the descendants of Sampson. They consist of the progeny of Serpolet Rouan César, Glaneur, Hardy, Harpon, Ouvrier, Bayard, Sarcus, Corlay, Begonia, Nougat, etc.

Conclusion. — In France, as in the United States, the trotter capable of resisting the constant increase in the trotting-pace will be the result of many intercrosses of the Sampson blood, and the race can only be improved in this manner.

934 - **New General Purpose Breed of Fowl Developed by Blending Characters of Three Established Breeds** — See No. 942 of this *Review*.

935 - **The Sardinian Horse** (1).— MORESCHI, B (formerly Director General of Agriculture), in *L'industria lattiera e zootecnica* Vol. XIX, No. 2., pp. 15-16 ; No. 3, pp. 27 28 ; figs. 2 No. 40 pp. 39-40, figs. 2 ; No. 5: p. 51. Reggio Emilia, Feb.-May, 1921.

Italian authorities on horses have long maintained that it would be very advantageous to breed Arab horses in Sardinia and as long ago as 1874 the oriental stallion, Osmanié, was sent to the State Stud at Ozieri. This animal was at work until 1893, and survived 582 mares, which produced no less than 300 foals. It is not always possible to import Bedouin Arab stallions, which alone can by regarded as belonging to the original stock: since the establishment of the Kingdom of Italy (1870) 7 or 8 have been introduced, the last being brought over in 1906 and 1907. Pure-bred Eastern horses have been purchased in Hungary, France, and even in Russia (in 1894, "Dsingiskhan", a $^3/_4$ blood Arab, was bought from the Government Stud et Baholma, this horse served a thousand mares in Sardinia and was the sire of 500 handsome foals in 25 years.

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(1) See *R.* Feb. 1919, No. 224 ; *R.* March, 1921, No. 316, 3 (*Ed.*)

In France, an Arab stallion is always chosen as the sire for the horses and used by the light cavalery. Not long ago, the French studs boasted of a certain number of Arab stallions 50 of which had been bought in the East. The best French horses fo Arab blood are to by found in the districts of Tarbes, Pau, and Pompadour.

There are two State horse-breeding establishments in Sardinia, the Ozieri Stud, and the Bonorva, or more correctly, the Burgos, rearing dépot. The latter takes the foals bought in the island by the ministry of war, at the age of 2 or 3 years, for the cavalry, and keeps them till they are 4 ½ before sending them to the regiments. This is done, in order to prevent the breeders ruining the animals, which they cannot sell, by working them too early or hobbling them.

The author suggests the formation, by an Association of Agriculturists subsidised by the State, of grazing grounds for foals and provided with sheds to give shelter during the winter. This would reduce to a minimum the time spent by the animals at the Government Dépôts, and thus effect a considerable saving in expense.

All the horse-breeders of Sardinia are now agreed as to the advantage of the introduction of Arab blood. In the last 20 years, the Ozieri Stud has increased rapidly; in 1899, there were 48 stallions distributed among 35 Stations; in 1920 the Stud boasted of as many as 131 which, in the spring, were kept at 68 centres. Of these horses, 90 were born and bred in the island, and 41 had come from elsewhere.

In 1915, the Stations for selected mares began work in the island. There are, at the present moment, as many as 16, each with 40 of the best mares the country has to offer.

The owner, in addition to the free service of the stallion receives 150 *lire* or even 200 *lire*, if the foal is born alive and healthy. He has to pledge himself not to sell the mares, to bring them to be served by the chosen stallion, and to take every care of the mares and foals. When 2 or 3 years of age, the entire colts may be bought by the Ministry of Agriculture for the Government Dêpôts at a price not below 4000 *lire*. The mares can become brood-mares and obtain the premium above-mentioned. A large number of brood-mares have been given to the Stations for selected mares by Bedouin Arab stallions introduced into Sardinia; for instance Asciar has 9 fillies there, Sabasciar 16, Etnen Escrin » 11, Tisa 12, Talata 5, Sitta Arbain 4, Saba 12, and Talata Escrin 23.

In January 1919, the Government were able to acquire in the island, 12 entire colts, bred in the Stations for selected mares, at prices varying from 4000 *lire* to 8000 *lire*; 14 other stallions were also bought there for the Ozieri dépôt for from 4500 to 9000 *lire*.

The Sardinian horses supplied to the army proved most satisfactory, even as far back as 1893. One Sardinian mare carrying a rider, covered the distance from Bergamo to Naples in 10 days.

Breeding-studs with many brood-mares are rare in the island; some, however, exist in the Bosa district; as a rule, the Sardinian only keeps the number of mares to actually needs, and these he has served annually, in order to provide him with foals. The author gives some information regarding certain small breeding establishments which are worthy of mention, if not for their size at least for the quality of their products. There are several in the province of Sassari.

In Sardinia, there are 131 State stallions, and as many licensed by the Government. If the unlicensed animals are also taken into account we may say that there are 300 stallions which serve no less than 12 000 mares annually, and the foals born every year are 6000, or even more. Before the war. the State bought 1000, and the rest were bought and sold privately; in 1918, 4800 horses were exported from the island.

936 – **Exsperiments Made in the United States on the Value of Cottonseed Meal as a Partial Substitute for Grain in a Ration for Horses.** — BELL, G. A., and WILLIAMS J. O., (Animal Husbandry Division) in *United States Department of Agriculture, Bulletin* No. 929, pp. 1-10. Washington D. C., Dec 17, 1920.

The objects of the experiment were to determine the value of cottonseed meal as a partial substitute for grain in a ration and also to determine the amount of cottonseed meal which can be fed with safety to work horses.

TABLE I.

Horse	Ration				
	Maize	Oats	Oat hay	Wheat bran	Cottonseed meal
	lb.	lb.	lb.	lb.	lb.
Stanley	—	18	16	—	2
Virginia	—	12	8	3	—
Maude	10	—	10	—	1¼
Myrtle	—	12	8	3	—
Nell	—	6	8	2	—
Queen	—	12	8	3	—
Fauna	—	15	10	3	—
Pet	10	—	8	—	3
June	—	16	16	—	1½
May	—	18	16	3	—
Castanette	—	12	8	—	3
Gladstone	—	10	10	2	—
Georgia	—	8	10	2	—
Brown Bess	—	10	10	—	2
Evarts	—	12	10	2	—

TABLE II.

Horse	Weight at beginning of experiment	Final weight	Gain (+) or loss (—) in weight	Meal fed at beginning of experiment	Meal fed at end of experiment	Effects observed
	lb.	lb	lb.	lb.	lb	
Stanley . . .	1510	1425	— 85	0.25	2	Intermittent colic attacks when fed on large amounts of cottonseed meal.
Virginia . . .	1500	1570	+ 70	—	—	
Maude . . .	1520	1670	+ 150	0.25	1.25	Refused ration containing over 1 lb. of cottonseed meal.
Myrtle . . .	1475	1475	—	—	—	
Nell	1443	1485	+ 42	0.25	1.25	Died Sept 25 from colic Post mortem examination showed malformation of small intestine. Death not attributed directly to feeding cottonseed meal
Queen . . .	1295	1410	+ 115	—	—	
Bertina . . .	1520	—	—	0.25	—	
Fauna . . .	1770	1780	+ 10	—	—	Died Sept. 8, stomach and intestines highly inflamed from excessive feeding of cottonseed meal.
Pet	1325	1480	+ 155	0.25	3	
June	1250	1375	+ 125	0.25	1.50	No ill effects observed, although the mare refused to eat large quantities of meal.
May	1315	1390	+ 75	—	—	
Castanette . .	1260	1440	+ 180	0.25	3	No ill effects observed.
Gladstone . .	965	950	— 15	0.25	—	Feeding cottonseed meal discontinued june 16. The animal constantly refused to eat a ration containing it.
Georgia . . .	965	960	— 5	—	—	
Brown Bess .	970	940	— 30	0.25	2	No ill effects observed.
Evarts . . .	995	940	— 55	—	—	

Sixteen horses (4 pure-bred Morgans and 12 pure-bred and grade Percherons) were used and 7 were used for control purposes. One mare died from an attack of pneumonia. All the horses were in splendid condition at the beginning of the experiment except one. Owing to the apparent dislike to the taste and odour of cottonseed meal it was mixed with wheat bran.

Only fresh, finely ground cottonseed meal was used and whole oats was used as the principal grain ration : the roughage fed was good quality timothy hay used *ad lib.*

The rations varied with the appetites of the animals. At the beginning of the experiment (October 1, 1917), the daily rations were as follows oats 8 to 27 lb., timothy hay 12 to 20 lb., wheat bran 3 lb., cottonseed meal 0,5 lb., For horses who ate satisfactorily or showed no signs of illness, the cottonseed meal was increased gradually from 0.5 lb., to 0.75 lb., 1 lb., 1.25 lb., 1.60 lb., 1 75 lb., and from 2 lb.. so that during the last period of experiment the daily rations were as shown in Table I:

The summary of experimental feeding is given in Table II.

Mares fed on cottonseed meal during the period of pregnancy did not show any ill effects nor did the colts when foaled.

23 rations are suggested, the amount of cottonseed never in any case exceeding 1 lb. per 1000 pound horse. Although some animals will consume more it is not advisable to exceed this limit. The mares in this experiment thrived better and consumed their ration containing cottonseed meal more satisfactorily after they were turned out on pasture.

In any case, horses should be taught to eat cottonseed meal by giving them a very small quantity at first (about 0.25 lb., per day), and increasing it slowly so that they gradually become accustomed to the taste and odour of the meal.

937 – **Notes on Some Characteristics of Icelandic Milch Cows** — PALL ZÓPHÓNIASSON in *Bunadarrit* 34 *Aaeg Reulkiavik* 1920. Summarised in *Nordisk Jordbrugsforskning*, Part 4, pp. 147-148, and p. 150. Copenhagen, 1920.

These studies deal with 2739 cows coming from all the different districts of the island, except Östland, and are based on colour data taken from the cow-testing registers.

The author describes 11 different colours and 19 shades, which can be divided into 7 groupes as follows: —

1) Red (Raudar): red is entirely predominant, or slightly intermixed with white.

2) Black (Svartor): completely black, or with a little white introduced.

3) Kolóttar: spotted red and black.

4) Striped (Bröndottar): with stripes and bands of red and black.

5) Black-brown (Mösvartar); tinged with black.

6) White (Hirtar).

7) Grey (Gráar): chiefly white with a red or black markings.

Red	37.9 %	Spotted	5.6 %
Black	33.9	White	1.7
Striped	10.4	Black-brown	0.5
Grey	10.0		

According to this grouping, the 2729 cows may be divided as follows.

The author considers the striped animals to be of Jersey origin, probably the descendants of cows imported by the Irish monks who were already settled in Iceland when the Normans landed there. This type of cow is to be found chiefly in the places where the monks had their monasteries, and they give milk with a high fat content.

As regards yield and composition of the milk the author quotes the following data taken from the registers of the Iceland cow-testing associations for Nord and Vestlandet: —

The maximum fat milk yield obtained was 4235 kg. with 3.42 % butter fat (average of 3 years) : the maximum fat content was 4.53 % from 3643 kg. of milk (in 1 year). One cow during 10 years gave en average of 3555 kg. of milk with 4 % butter fat per annum.

938 - **Lattolo I. C. A. as a Calf Feed.** — MANVILLI, V, in the *Rivista di Agricoltura*, Vol. XXVI, No. 23, pp. 327-330, figs. 2 ; No 24, pp 340-344, 2 diag figs. 1 Parma, June 10 and 17, 1921.

The author has made a trial of the new lacteal flour, known as «Lattolo I. C. A. », manufactured by the firm of Ing, FINZI, Dr. EMPRIN and Co. at Candiolo (Turin). The tests were carried out on the cow-sheds of the Bonafous de Lucento Agricultural Institute at Turin.

The product is a fine homogeneous flour of a greyish colour, with a subtle aromatic odour, and a sweet flavour. When mixed with water in the proportion of 100 gm. per litre, it yields a liquid which, according to the makers, is equal in nutritive value to one litre of milk, and only costs 25 *centesimi* per litre, a price corresponding to 2 50 *lire* per kg., of the powder.

The author tested « lattolo »with young calves and heifers of the Schwytz breed, that had previously been fed with a ZAPPA-PIROCCHI bottle, and later hand-fed from a pail.

A young heifer that had been suckled by its dam until the 25th day, was given "Lattolo I. C. A." as a partial substitute for natural milk in the proportion of 1/3 for the first 25 days, 1/2 the following 25 days, and 2/3 for the subsequent 20 days; in all, for 40 days, aften which the heifer was weaned, and fed on grass, hay, and groundnut cake (300 gm.) At the end of the experiment, when the heifer was 135 days old it had consumed 58.75 kg. of " Lattolo powder " and its weight was 144 kg.

A young calf reared in the same manner weighed 134.50 kg. on the 120th day, and consumed 50.2 kg. of " Lattolo " powder.

Although it is true that the increase in weight obtained with " Lattolo " is slightly below the theoretical figure of 950 gm. per head per day, for calves reared on natural milk nevertheless this leaves a sufficient margin of profit on districts like those where the experiments made, as the breeder can sell his milk direct in the town.

" Lattolo I. C. A. " is relished by animals ; calves bronght up on it always enjoy perfect health. The product can also by added to skim milk. From the 10th. day a calf can be reared exclusively on skim milk to which " lattolo " has been added ; the amount given being 1 litre per 6 kg. of live-weight. In order to replace the substances removed, 50 gm. of " Lattolo I C. A. " per 1 litre of skim milk is sufficient.

939 - **Pig Breeding in Latium** (1) — BIANCHINI, B, in the *Rivista Agricola romana*, Vol. XLVII, No. 6, pp 140-145. Rome, June, 1921.

In Latium, where pig-breeding is far from being as important as it might easily be, the Roman breed known also as the maremmana (marsh) or macchiarola (maquis) pig is kept. This animal is hardy, black, well-adapted for grazing, and has much bristly hair on its back. Its flesh is fine in flavour, but deficient in fat In the north of the province, pig-breeding is carried out in some places in a systematic manner, selected animals from Umbria and Tuscany being used for the purpose. In the south, the Teano breed (or pelatelli casertani) is found. This was the original of the stock of the English Yorkshire and Berkshire breeds.

Two systems of breeding are practised, in the one case, a few pigs are kept by peasants, agricultural workers, etc. the animals bring fed on skim-milk, kitchen scraps, or market refuse ; in the other, large herds of swine are reared in the woods of Turkey oaks or ordinary oaks, where they roam in the wide clearings traversed by never-failing streams, and are collected together in the evening by the sound of the « vorgna » a kind of bagpipe

The chief aim, of the first method is to provide meat and fat for the, family or for private trading ; the object of the second is to increase the number of pigs.

For Latium the author advises an intensified and improved method of pig-breeding based on improved sties ; the use, by breeders in the neighbourhood of Rome, of kitchen and table scraps, which could be obtainned and collected at small cost in the town ; commercial crossing, that is to say, of one generation, with Yorkshires, or Large Blacks. (In 1897, red Tamworths were introduced to improve the local race at Fogliano, on the estates of Prince CAETANI, Duke of Sermoneta ; the experiments appear to have given excellent results, and would be well worth repeating) In conclusion, the author advocates the selection of the native breed, the late development and small size of the animals being to a large extent compensated for by the flavour of the meat, and their unusual hardiness.

940 - **Notes on the Poultry Stock in Belgium** — RASQUIN, M in *Journal de la Société Nationale des Agriculteurs de Belgique*, Year III, No 23, pp 160. Brussels June 4, 1921.

The statistics drawn up at the time of the Armistice gave the number of poultry in Belgium as about 5 million , before the war there were as many as 12 million head. For the last 2 years, poultry-rearing has been carried on with the greatest energy and broods of chicks are to be seen everywhere this year. Large poultry-breeders have become very numerous so that it may be predicted that by the end of 1921, the poultry will have risen to 10 million.

In this reconstruction of the industry, the question of laying, non-sitting breeds has been more considered, and some very distinct races are seen in the different villages.

In the Walloon distruct, the Leghorn is widely kept, while in Flanders, the Brackel shows signs of being once more the favourite.

Foreign breeds, consisting for the most part of table varieties are less numerous than formerly, as egg production is the chief object at present. Every encouragement is given to the rearing of Belgian breeds, which in future should be the basis of the poultry industry. On the other hand, a practical school for small poultry-farmers is to be started at Mariemont (Province of Hainault) where the question of breed is to be the first consideration. The attention of breeders ought chiefly be directed to la Campinoise, la Brackel, la Brabançonne, la Herve, and l'Ardennaise as laying races, and to Concou de Malines as a table variety.

941 - **The Sicilian Breed of Fowl.** — TUCCI, F., in *Allevamenti* Year II, No. 7, pp. 209-211 2 coloured figs. Palermo, July 1, 1921.

In Sicily, poultry-keeping is practically limited to the small villages where the agriculturist sleeps, and his family lives, and is little practised on the large farms where there are no peasant dwellings. From having been reared in these villages, the Sicilian fowl has developed an aptitude for living in a confined space. There are however poultry farms of some size in the province of Messina, the ancient country of Modica (province of Syracuse), and at Paceco, and Marausa (province of Trapani). The Marsala fowl even enjoys a merited reputation.

The Sicilian fowl has some characters in common with the Italian breed, but is distinguished by its smaller size, and the superior egg-laying qualities of the vigorous young hens. The Marausa fowl is the result of selection carried out by the author at the Palermo zoological Institute. It is characterised by the special shape of its crest, which is like a cup with a dentate rim, and by its grey-green shanks. Its plumage varies in colour.

The Marsala fowl was accidentally introduced into North America. It was one of a number of birds shut up in a coop, but was spared by the crew because, throughout the whole voyage, it continued to lay eggs of a large size Its progeny was carefully selected, and gave rise to the " Sicilian buttercup breed, which stands confinement well.

The Sicilian Marsala fowl, which has been selected by the author since 1913, has the following characters :—

COCK — Head of right size, a little elongated, wide at base. *Beak* sufficiently long, with strong base, and tip a little recurved. *Cheek* reddish. *Crest* large, double, on form of cup with dentate edgl. *Wattles* well-developed and long. *Eyes* black, encircled with yellowish red. *Earlobes* white above, pink in the middle, and red below ; surface smooth.

Neck of right length, slightly curved.

Back nearly straight, sloping slightly backwards.

Shoulders wide.

Chest of right width, flat and slightly rounded.

Legs strong ; shanks clean, grey-green, 4 toes.

Tail well-developed, erect, with large, strong-rectrices (tail quills).

Feathering golden.

Size average ; only exceptionally do the birds weigh 2-5 kg or a little over.

HEN. — Except as regards secondary sexual characters, has the same characters as the cock. The comb is less developed, the edges tending to fall over on one side.

The *pullets* begin to lay at 6-7 months old, and in the case of birds hatched in March-April from Oct. 1-Sept. 30, producing 60-70 eggs the first year, the maximum of 160 being laid the second year, and only 140 the third year. These figures refer to lots of 10-12 kept in small runs ; larger flocks always kept in pens lay somewhat fewer eggs This fowl is not a *good sitter,* it is very *hardy.*

The Sicilian fowl does well when allowed to range at will, but it does not lose its good qualities in confinement.

942 - **Lamona** (1) **A New American Breed of Poultry.** — LAMON, H. M. (Bureau of Animal Industry U. S. Department of Agriculture,, in *The Journal of Heredity*, Vol. XII, No. 1, pp. 3-29, Plates 27. Washington, January, 1921.

A new general purpose breed of fowl developed by blending the egg-producing and meat-producing characters of 3 established breeds.

The object of crossing the latter was to obtain a new breed of general purpose fowls of the type, size, and commercial qualities of the Dorking, with white plumage, yellow skin, 4 toes, yellow legs, and red ear-lobes, which would lay large white eggs. The present general purpose breeds lay a brown-shelled egg, whereas eggs with white shells are preferred on the market.

The breeds used for crossing were the Dorking, White Plymouth Rock, and the single Comb White Leghorn. The crosses were made as follows :

Year	Pen No	Mating
1912	Original mating	White Plymouth Rock ♂ × Silver Gray Dorking ♀ .
1913	22	S C. White Leghorn ♂ × hybrid females from 1912 mating.
	18	S. C. White Leghorn ♂ × Silver Gray Dorking ♀ .
1914	9	Male hybrid out of pen 22 × hybrid females out of pen 18.
	7	Male hybrid out of pen 22 × females hybrid out of pen 18.
	17	Male hybrid out of pen 22 × females hybrids out of pen 22.

In the following years, the breeding operations consisted of constant selection, as no new crosses were made, nor was any other pure-bred individual of the three original varieties employed.

In the successive generations (1913-1920) the plumage, colour, number of toes, leg colour, and ear-lobe colour were distributed as follows:

1913 : *Plumage colour :* White 3 ; other colours 28.

Number of toes : Of 107 chicks, 50 had 4 toes on each foot, 42 had 5 toes on each foot ; 13 had 4 on one foot and 5 on the other ; 1 had 5 on one foot and 6 on the other ; 1 had 60 toes on each foot.

Leg colour : 20 had white legs, 2 yellow ; 4 white of a yellowish tint, 1 yellow with whitish cast. Total 27.

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(1) The official designation of the new breed. (*Ed.*)

Lobe colour : 19 white ; 3 nearly white ; 1 one-half red and one-half white ; 1 nearly red ; 24 in all.

1914 : *Plumage colour :* White 68 : other colours 95.

Number of toes : of 188 chicks, 137 had 4 toes on each foot ; 39 had 5 toes on each foot ; 12 had 4 toes on one foot and 5 on the other.

Leg colour : yellow 69, white 81 ; the rest (out of a total of 136) had legs of the following colours; yellowish, yellowish white, greenish yellow, blackish yellow, white with a few spots, willow, and black.

Lobe colour : Red 7, the rest of the birds had lobes varying from white to red. Total number 163.

1915 : *Plumage colour :* White 25 ; other colours 64.

Number of toes : Out of 395 birds, 308 had 4 toes on each foot, 68 had 5 on each foot, 14 had 4 on one foot and 5 on the other, 5 had 5 on one foot and 6 on the other.

Leg colour : yellow 42, white 39, the other birds had legs of all shades from white to yellow. Total number 90.

Lobe colour : Red 15 ; nearly red 19 ; 23 one-half red ; 13 white, the rest being white and red. Total 90 birds.

1916 : *Plumage colour.* White 46 ; other colours 132.

Number of toes : Out of 337, 268 had 4 toes on each foot ; 39 had 5 on each foot ; 12 had 4 on one foot and 5 on the other.

Leg colour : yellow 97, white 64 ; the rest were of all shades from yellow to white. Total number 170.

Lobe colour : Red 47, nearly red 39, white 10. Total 160. 2 fowls with red ear-lobes laid white-shelled eggs.

1917 : *Plumage colour :* White 208 : other colours 311 ; total 519.

Number of toes : Out of 805 birds, 712 had 4 toes on each foot ; 68, had 5 on each foot ; 1 had 6 toes on each foot, 20 had 4 on one foot and 5 on the other, 4 had 5 on one foot and 6 on the other.

Leg colour : yellow 392 : total 520 birds.

Lobe colour : Out of 520 birds, 140 had red ear lobes ; 15 hens with red ear-lobes laid white-shelled eggs.

1918 : *Plumage colour :* White 296. Total 479 birds.

Number of toes : 470 out of 516 had 4 toes on each foot.

Leg colour : yellow legs 445 ; total number of birds 500.

Lobe colour : Out of 479 birds, 119 had red ear lobes ; only 3 of the hens with red ear-lobes laid white-shelled eggs.

1919 : *Plumage colour :* White 390 : total number of birds 436.

Number of toes : Out of 437 birds, 428 had 4 toes on each foot and 9 had 5 toes on each foot.

Leg colour : with yellow legs 397 ; total number of birds 435.

Lobe colour : Out of 433 birds, 150 had red ear-lobes, and of these, 13 laid white-shelled eggs.

1920 : The total number of hens with red lobes that laid white-shelled eggs was 45. As to the number of toes, 664 had 4 toes on each foot, 16 had 5 toes on each foot, 2 had 4 toes on one foot and 5 on the

Lobe colour: 19 white; 3 nearly white; 1 one-half red and one-half white; 1 nearly red; 24 in all.

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Number of toes: of 188 chicks, 137 had 4 toes on each foot; 39 had 5 toes on each foot; 12 had 4 toes on one foot and 5 on the other.

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Leg colour: yellow 97, white 64; the rest were of all shades from yellow to white. Total number 170.

Lobe colour: Red 47, nearly red 39, white 10. Total 160. 2 fowls with red ear-lobes laid white-shelled eggs.

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Lobe colour: Out of 433 birds, 150 had red ear-lobes, and of these, 13 laid white-shelled eggs.

1920: The total number of hens with red lobes that laid white-shelled eggs was 45. As to the number of toes, 664 had 4 toes on each foot, 16 had 5 toes on each foot, 2 had 4 toes on one foot and 5 on the other, and 2 had 5 toes on one foot and 6 on the other. Total number of birds 684.

Of the 464 cross-bred chicks 155 had red lobes, 64 had nearly red lobes, 64 had three-fourths red lobes, 80 had one-half red lobes, 28 had one quarter red lobes, 51 nearly white lobes and 23 white lobes. Of the 472 chicks, 470 had yellow legs and beak and 2 had white legs and beak. Of 433 cross-bred chicks hatched from the white matings, 401 had white plumage, though a few males showed some brass on the back.

30 birds had Red Pyle markings varying from very heavy, with buff, running into other sections, to very light, with only a touch of buff on head, or buff, or red, on shoulders of males.

3 birds were white with black splashing, or ticking, or both. Out of 35 cross-bred chicks hatched from the buff-breasted matings, 24 showed Red Pyle markings in some degree, 1 poor Dominique markings, 1 poor Brown Leghorn markings, 3 poor, or light, Dominique markings with splashings of buff or white, 4 white splashed with grey, buff, red, or black, or a combination of these colours; 1 white with a little buff on the surface, 1 brownish-black stippled and shafted with buff, buff lacing on hackle, and white lacing, or spangling, and salmon on breast.

The live-weight of 208 pullets hatched in 1920 averaged 4.28 lbs. while the cockerels weighed on the average 6.25 lbs.

About January 1, 1921 the weights of birds of different ages were as follows:

	Cross-Bred Cocks average weight
Hatched in 1918	6 666 lbs.
» » 1919	7.15 »

	Cross-Bred Hens average weight
Hatched in 1916	6.3 lbs.
» » 1917	5.6 »
» » 1918	5.38 »
» » 1919	5.87 »

One cockerel whose age was unknown, as it had lost its leg-band, weighed 8.1 lbs.

The colour of the plumage may be said at the present time to be quite fixed; the colour of the ear-lobe, however, still varies much, although a considerable number of the fowls have the red ear-lobe that is required. The proportion of five-toed birds with white legs is very small, so that 4 toes and yellow legs may be regarded as fixed characters.

In body type, there has been wide variation but a long body has now been obtained though it is not always carried in a horizontal position.

The colour of the eggs has been the most difficult character to fix, but the fact that numerous individuals have been obtained possessing red lobes and laying white eggs, encourages the belief that the fixation of this combination of characters is merely a matter of continued breeding and infinite pains in selection.

943 - **Contribution to Our Knowledge of Sex Formation in Bees** (1). — JEGEN, G. in the *Schweizerische Bienen-Zeitung*, Year XLIV, No. 6, pp. 217-221. Aarau, June, 1921.

The generally-accepted theory ot the present day is that false-drones come from unfertilised eggs, and that the males from the eggs of unfertilised queen-bees, queen-bees that are too old, or male-bearing workers are capable of fertilising.

Recently, however, the author has tried to follow, with the help of cytological researches, the maturation of the sperm-cell of males produced by the eggs of working-bees. He subsequently carried out experiments in the open, in order to discover whether abnormal false drones actually possess the power of fertilising.

On examining the phenomenon of arrenotokia due to the absence or infertility of the queen-bee, and taking into account what happens in a normal colony, we unavoidably come to the conclusion that the function of arrenotokic workers in its present form can only be a secondary kind of reproduction, which was once natural, but has been modified in the course of time, on account of altered life conditions. We may even ask whether it is not an atavic return to the capacity of laying normal eggs, and consequently whether the males now coming from such arrenotokic eggs are not degenerate products.

The examination of males produced by arrenotokic workers has revealed that at the time of the maturation of the sperm-cell, there is hardly any mitosis properly so-called, and further, that the spermatozoa undergo premature degeneration in the spermiducts.

The karyokinetic division giving rise to the two polar bodies is very indistinct, and sometimes entirely wanting, which alone is enough to show that we have here to do with the abnormal maturation of a reproductive cell on the point of degeneration. Further, it is noticeable, that the production of active spermatozoa does not take place in most of the false-drone nymphs in the more advanced larval condition. In fact, mating these abnormal males with normal females has given negative results; in no case did the female lay normally.

Males produced by arrenotokic workers are thus incapable of fertilising. From what has already been said, the question that now presents itself is, whether virile males produced by normally fertilised females really come from unfertilised eggs. In this connection, the author draws attention to the fact that the observations made during the maturation of the sperm-cell render it probable, that there are two kinds of spermatozoa, one with 8 chromosomes coming from the spermatid, and another with 9 chromosomes derived from the second polar body, in which case, this third element would seem to represent a specific sexual chromosome determining the male sex.

Allowing that both kinds of spermatozoa are active, it appears very possible that, owing to food and temperature, the spermatozoon determining the male sex may be active in the body of the queen-bee, and at the time only such spermatozoa leave the spermatheca fertilising the ova as they pass into the oviduct, but that when the action of the stimulating factors ceases, the specific spermatozoon loses its power.

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(1) See *R.*, Feb., 1920, No. 240 and March., 1920, No. 351. (*Ed.*)

The data so far obtained do not permit of any definite conclusion being reached, and in order to prove which theory is correct, it will be necessary to collect and examine the results of further observation and of other careful experiments.

FARM ENGINEERING

944 - **The Spring International Exhibition of Motorculture, Paris Febrauary 10-20, 1921** (*1). — I. Bonnamaux, H, in *La vie aux champs*, Ser. 3, No. 11, pp. 6-9, figs 7, Paris, Jan. 25, 1921. — II. *Bulletin de la Chambre Syndicale de Moto-culture de France*, No. 8, pp. 4-5. Paris, Jan.-March 1921.— III. Diffloth P., in *La vie agricole et rurale*, Year 10, Vol. XVIII, No. 15, pp. 229-234, figs 3, Paris, Apr. 9, 1921.

The exhibition of motorculture, which opened on February 10 on the race course of Vincennes, was organised by the "Chambres syndicales de la Motoculture française et des fabricants d'appareils agricoles".

II. — The following firms exhibited :—

Machinery.

Agricultural, 25, route de Flandre, Aubervilliers :— "Holt," "La Crosse," "Samson" tractors.

L'Agro (limber tractor), 116-bis, rue de Tocqueville, Paris :— "Agro" tractors.

Allied Machinery Company of France, 19, rue de Rocroy, Paris :— "Cletrac" tractor.

Amiot, H. (Societé Anonyme la *Charrue Automobile*), 8, rue de la Victoire, Paris :— "Gerbe d'or" motor plough.

Ara (appareils routiers agricoles), 2, rue de Vienne, Paris (8e): — "Ara" tractor.

Ateliers de Construction de Chatou, 37, boulevard de la République :— Chatou tractors-haulers.

E. Bauche & Cie, Le Chesnay près Versailles :— Bauche motor-hoe.

Beauvais et Robin, 31, rue de Maine, Angers :— "Amanco" tractors.

Blum & Cie, 8, quai Gallieni, Suresnes :— Tourand-Latil tractor.

Bocquentin, 15, boulevard des Italiens, Paris : "Praga" motorplough.

Borel (Etablissements), 64, quai National, Puteaux :— "Rumely-Oil-Pull" tractor.

Bouzinac, 33, rue Rousselle, Puteaux :— Supplementary cultural implement.

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* Most of the models exhibited are well known and have been described in the *Review of Agricultural Intelligence and Plant Diseases*, June, 1919 No. 768; Oct.-Dec. 1919, No. 1222; March, 1920, No. 354; June, 1920, No. 686; thus, among *windlass traction apparatus* :— the De Dion-Bouton apparatus for power cultivation (2); Albert Douilhet windlass (4); Filtz-Grivolas hauler (4); Agro limber tractor (3) among the *motorploughs* :— Gerbe d'Or (3); Tourand Latil (1), Excelsior (3), Piaga (3), Moline (2), Rip (2), Chapron (1); and among the *direct traction apparatus* :— the Fiat (3), Scémia V., Nilson (3), Austin (2). Ford (2), Rumely (3), Sanduski (3), Renault (3), Neverslip (3), Oncle Sam (5) etc. tractors. New comers and those which have been more or less modified or previously described in this Bulletin with less detail, are described in the Article.

(1) See *R.*, June, 1919, No. 768. — (2) See *R.*, Oct.-Dec., 1919, No. 1222. — (3) See *R.*. (March, 1920, No. 354. — (4) See *R.*, June, 1920, No. 686. — (5)See *R.*, June, 1921, No. 664. *Ed.*)

Case de France (Compagnie), 251-253, faubourg Saint-Martin, Paris :— Case tractor.
Chapron B., 45, rue de la République, Puteaux :— Chapron motor plough and tractor.
C. I. M. A., 155, avenue du Général-Bizot, Paris :— "Titan," "Mogul" and International tractors.
Dens & Cie, 5, cité Trévise, Paris :— Sandusky tractor.
De Dion Bouton, quai National, Puteaux :— De Dion ploughing windless.
Doriot, Flandrin et Parant, 105, boulevard Saint-Denis, Courbevoie :— "César," D. F. P. vineyard tractor.
Douilhet, 9, rue Marcellin-Jourdan, Caudéian :— Douilhet ploughing windlass.
Dubois, R., 130, avenue de Neuilly, Neuilly :— R. D. Tractor.
Dupuy, G., 31, rue Poussin, Paris :— Midwest Utilitor " tractor.
Egret, J., 48, boulevard du Temple, Paris ·— Supplementary cultural implement
Ch. Faul et Fils, 47, rue Servan, Paris :— John-Deere tractor.
Fiat, 115, avenue des Champs-Elysées Paris :— " Fiat " tractor
Ford (Automobiles), 33-37. boulevard Albert 1er, Bordeaux :— "Fordson ' tractors.
General Motors export Company, 63, avenue des Champs-Elysées, Paris :— "Samson" tractors.
Globe, 28, rue Saint-Lazare, Paris :— "Globe" tractor
The Johnston Harvester Company, 148, boulevard de la Villette, Paris: — Supplementary cultural implement.
Lacour & Fabre (de), 60, rue de la Chaussée-d'Antin, Paris :— "Le Gaulois" tractor.
Lambert-Rivière (Société Commerciale), 45, avenue de la Motte-Piquet, Paris :— "Holt, International" "Mistral" tractores.
Mahieu et C.ie, 55, rue de Prony, Paris :— "Oncle Sam" tractor.
Massey Harris, 138, avenue Jean-Jaurès, Paris :— Supplementary cultural implement.
Matériel Agricole Messidor, 208, boulevard Felix-Faure, Aubervilliers :— T. P. Vine cultivators and cultivators.
Moline Plow Company, 159-bis, quai de Valmy, Paris :— Moline tractor.
Nemours Trading Corporation, 63, boulevard de Picpus, Paris :— Emerson tractor.
Oliver Chilled Plow Works, 75, boulevard de Picpus, Paris : — Supplementary cultura implement.
Perrier, H., 102-106, avenue Philippe-Auguste, Paris :— Supplementary cultural implement
Pilter, Th., 24, rue Alibert, Paris :— Austin-Avery tractors.
Ravaud, A., 1, rue des Italiens, Paris :— "Excelsior" motor-plough.
Renault, L., at Billancourt: — Renault agricultural and forest tractors.
Rip (Machines Agricoles), 12, rue Boissy-d'Anglas, Paris :— "Rip" tractors.
S. C. E. M. I. A., 9, rue Trouchet, Paris :— "U. 20 Scemia" tractor.
Société Agricole, Industrielle et Commerciale du Sud-Ouest. 65, allées Jean-Jaurès, Toulouse :— "Twin-City" tractor.
Société Auxiliaire Agricole, 47-49, rue Cambon, Paris :— "Agrophile-Pavesi" tractor.
S. O. M. U. A., 19, avenue de la Gare, Saint-Ouen :— "Somua" motor cultivators.
La Traction et le Matériel Agraires, 18, rue de Mogador, Paris :— "Nilson," "Agro," R. "Beemann" tractors.
R. Wallut & Cie, 168-170, boulevard de la Villette, Paris : — Mac Cormick tractors.

LUBRICANTS.

Société andré Fils, 8, rue de la Tour-des-Dames, Paris.
Vacuum Oil Company, 34, rue du Louvre, Paris.
Société d'Exportation Industrielle, 1 rue Blanche, Paris.

TRACTORS FOR POWER FARMING.

III. — (1) The Mistral tractor of the CULTURE FRANÇAISE — It has the fewest possible parts. The parts can be taken out separately and are easily accessible. The triangular suspension, the selection of raw material as well as the very high coefficient of safety of the parts, make it a very strong apparatus.

The maximum out-turn is obtained thanks to:—

(1) The choice of the motor and radiator.
(2) The minimum of intermediate transmission parts and perfect suspension.
(3) The rational use of ball bearings.
(4) The entire adhesion to the ground without useless extra weight (the apparatus weighs only 1775 kg.) by means of its special strakes.
(5) The absence of a differential and the arrangement for disengaging the driving wheels. This prevents noise: the apparatus never gets stuck and clears obstacles easily.

The system of disengaging one driving wheel, right or left, enables the *Mistral* tractor to turn in a radius of 1.20 m. The headlands are thus reduced to a minimum.

The shape of the wheels in front ensures good steering of the apparatus. Its centre of gravity being very low, the *Mistral* tractor can be very much inclined for work in hilly ground.

Simplicity, strength and power ensure to the *Mistral* tractor the rapid amortisation of its purchase price and a low consumption of oil and fuel (petrol or paraffin at the choice of the purchaser).

(2) Samson Tractor has the following characteristics:— Vertical motor; 4 cylinders; 102 mm. bore; 140 mm. stroke; developing 20 H. P.; 10 H. P. at the bar. Fuel petrol or paraffin. Speed:— 2 forwards, 3 km. and 4.5 km.; 1 backwards, 2 km. Weight, 1400 kg Radius of turning 3.50 m. capacity of tanks:— petrol 12 litres, paraffin 75 litres.

(3) Amanco-Hart-Parr paraffin Tractor 30 HP. — It is characterised by the following essential points:— A simple, solid construction, result of 20 years of experiment; an economical output of work which can attain 40.79 (Bourges competition, August 1920) and even 54 ares per hour (Thorenbais-les-Béguines, Belgium, September 1920).

The consumption of ordinary paraffin used was 27 litres (Bourges competition, 1920) and 24 litres (Belgium competitions, 1920) per hectare.

I. — (4) Delieuvin Tractor. — Progresses on wheels. Previously entered only at the Chartres demonstrations (Autumn, 1920). It is characterised by an ingenious auxiliary gripping arrangement formed of 2 very light wheels placed behind the back axle and moved by the latter by means of a chain. These wheels furnished with stakes are normally raised by a spring, but are pressed strongly on the ground as soon as the resistance of the plough to forward movement becomes too great. This enables the tractor to exert an adhesion which is a function of the tractive effort and increases with it.

VINEYARD AND HORTICULTURAL APPARATUS.

(5) CHAPRON Tractors of 13-18 H. P. and 15-20 H. P. (1) and motor ploughs of the same maker of 10-15 H. P. and 15-20 H. P. — In the last-named apparatus the working parts are collected immediately behind the driving wheels to facilitate very sharp turning.

Each tractor has 2 means of steering, one acting on the driving wheels, the other on the small hack wheel placed under the seat of the driver, enabling the plough to be guided easily on steep slopes and the apparatus to be turned round almost on its own axis between the rows of vines. The driver, having in front of him all the steering apparatus, can control his work and regulate exactly the depth of work of the shares. The motor, which is very flexible, can run at from 300 to 1200 revolutions a minute. All the parts are made of hard nickel-chrome steel.

III — (6) The R. D. tractors are suitable for farming on a small scale and vineyards. Its small dimensions (total width, 0.95 cm.; base, 1.50 m.) enables it to move about freely in the thickest vineyards without fear of injuring the growth or uprooting the vines: it is easily capable of ploughing to a depth of 13 cm., and deeper in light soils; all cultivating implements — ploughs, harrows, rollers, cultivators, etc. — can be attached to it. Transmission is insured by 2 speed gears always in action, with optional disengagement of one or the other; the speed per hour is about 2 km. on the first and 5 km. on the second speed gear, the first including the reverse movement: the back wheels are driven by chains enclosed in sheet steel cases; a special mechanism allows of the automatic disengagement of one of the wheels when turning: in that case the whole motive power can be brought to bear on a single wheel, right or left; this arrangement enables very sharp turns to be made (about 3 metres diameter) and the deepest ruts to be got out of without difficulty.

The motor has two speeds: one of 500 revolutions a minute developing, stationary, 8 H. P. on the shaft; automatic regulation for the control of threshing machines, root-cutters, straw-choppers, etc.; the other of 800 revolutions developing a tractive force of 12 H. P.; working with petrol or paraffin as desired.

Being easy to drive, this apparatus is specially suitable for maimed persons. Model A is arranged so that it can be used as a locomotive on rails with 0.60 and m. 0.70 m. tracks.

I. — (7) The BREMANN hoer (2), used for market-garden cultivation. Its single cylinder 6 H. P. motor takes the place of a strong horse and allows of ploughing with a single plough or drawing a hoe, a sprayer, a harrow. It is chiefly used for cultivating in vineyards, where it draws a vine-dressing hoe and ploughs for earthing up and uncovering. It consumes about 3 4 to 5 litres of petrol.

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(1) See *R.* Mar. 1920, No 351 (*Ed.*)

(2) See *R*, March, 1920, No. 354 (*Ed*)

(8) The small 6 H. P. SOMUA apparatus, which works by means of a rotary tiller consisting of flexible teeth that cut the soil, is well suited for cultivating gardens.

(9) The PETARD and PREJEAN rotary cultivator (1).

III. — (10). The Midwest Utilitor. — This small tractor advantageously replaces a horse, for it does double the work at half the cost. It passes through vineyards and can till the smallest plot of ground. It is easily driven with a simple pressure of the fingers on the handles The machine itself supports its heavy parts which have not therefore to be held up as with an ordinary plough. The motor has an effective force of 4 H. P. and consumes little; it is therefore a quiet horse which is never tired. In fact, when it has finished work in the fields, by placing a belt on the pulley, it can be made to work any machine such as a churn, skimmer, threshing machines, pump, saw, etc. and most of the mechanical apparatus used on a farm.

The *T. P. Rotary Cultivator and Vine cultivator* is a mixed motor-cultural apparatus (weight 550 kg.) which can be drawn by a horse, an ox, a mule or even by an ass. It does not compress the ground and it does away headlands.

Its use enables implements (hoeing, rotary harrowing and all tillage operations up to 15 cm. in depth by 90 cm. in width) to be run rapidly over the ground. Its track is 80 cm. wide.

The driver has not to use force in his work, and as a seat is provided he can put in a long day's work.

The apparatus, working at the speed of a horse walking, can work up to 3 or 4 hectares in 10 hours. The motor only serves to rotate the implements; the fuel consumption is only 15 to 22 litres a day according to the depth of the work done. In vineyards and among plants in lines the nominal area worked is estimated at 6 ha. per day (depending on the spacing of the plants).

The T. P. Rotary Cultivator and Vine Cultivator ingeniously combines animal traction and mechanical working for vine cultivation, cultivation in lines in market gardens and in the Colonies.

PLOUGHS.

Among new ploughs, M. DIFFLOTH notes: — The reversible MESSIDOR ploughs for flat ground, which can be coupled behind any tractor. The MESSIDOR plough consists essentially of a supporting frame attached behind the tractor and supporting the mechanism for regulating the depth of ploughing. This frame is carried on two wheels in front, one of which, on the ploughing side, keeps the machine straight, and on a pivoting back axle mounted on two articulated wheels which automatically straddle the side of the last furrow.

On the supporting frame the body of the plough itself is jointed moving up and down round a strong longitudinal axle enabling one or other of the two series of mould-boards, coulters and cutters, arranged at right-angles on the structure, to be put into position for ploughing. This moving up and down is operated by means of a flywheel situated near the driver and working a simple mechanism requiring only a very small effort to be set in motion. Projections which can be regulated limit the up and down movement and oblige the driver to put his plough always in the desired position for ploughing. It is impossible for the driver to make the plough work in any position except that fixed by the projections, which ensures perfect regularity of the work.

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(1) See *R.*, Oct-Dec, 1919, No. 1222. (*Ed.*)

With the Messidor plough a high yield of power and great economy in working can be obtained from the tractor to which it is attached.

The tractor moves entirely on the unploughed land, thus using the minimum power for moving; there is much less wear of its parts and its wear and tear is reduced by a half.

With this apparatus any tractor can move backwards without unhitching the plough, so that it is possible to plough plots which cannot be ploughed with motors working with ordinary ploughs.

The regularity of the ploughing is the outcome of the simplicity of its regulation, of the symmetry and the automatic working of the arrangements for coupling, control and of handling. The moving up or down of the plough, turning, transport, are effected without touching any of the regulators affecting the ploughing.

The point of traction can be regulated and the coupling arrangement gives automatically the desired inclination to the plough, according to the side towards which the band of soil is turned. As the plough is entirely supported on its own wheels, ploughing is not effected by the movements which the tractor may make in crossing hollows or lumps in the fallow. It is automatically guided by the " bordayage " of its wheels, which ensures that the furrows are parellel.

The supports, the coulters and the cutter stems can be regulated in slope and spacing at the will of the operator. The coupling is arranged so as to have no effect on the adhesion or the steering of the tractor. The tractor, moving entirely on the fallow, does not crush the ploughed soil, does not compress the bottom of the furrow and the headlands, reduced to a minimum, are never trampled down, as the tractor never repasses over the same places.

The most usual type of Messidor plough is the three gang type which can plough to all depths down to 28 cm. and take a band 90 cm. wide. This model can be transformed in to a double plough by rapidly dismounting the two hind ploughs. This apparatus can be turned into a light double plough for certain tractors and into gang plough types with great ploughing width for special requirements.

The double Brabant plough is a fairly heavy implement, large and difficult to handle at the ends of the farrows. The application of the new limber with movable axle under the frame has entirely modified the working conditions of this plough.

A new double Brabant plough:— Victoire, is shown by the firms of Filtz and Grivolas. This arrangement constitutes an interesting experiment made in modernising our old agricultural implements; it is applicable both to light double ploughs drawn by animals and to heavier implements that can be coupled to agricultural tractors and can plough to depths of 20 to 25 cm.

This latter class of plough is therefore recommended to owners wishing to use tractors for cultivating level ground.

The axle is movable, and is fixed to the lower ends of two uprights acting as supports to the implement and jointed about their upper third round two gudgeons situated on the same axis and placed on the frame of the plough on the right and left of it. These two uprights can therefore turn round that articulation and their upper parts, slightly bent, form arms which can occupy all positions on a sector; the free ends of these arms are pulled forward by the action of two strong spiral springs which at the same time draw the axle backwards. That axle, is, when starting, drawn forward by the coupling itself by means of a rod and by the hauling chain, this latter first exerting its force on that axle, and afterwards mainly on the head of the plough itself. During this time the uprights turning round their axis take up a more or less inclined position determined by the extreme position of the arms coming against pins whose position on the sectors can itself be modified.

A depression of the whole plough results, which, coinciding with the starting of the plough produces gradual embedding in the soil, the springs acting as shock absorbers for both the plough and the tractor. That depression being capable of limitation at will, according to the position in which the pins are placed, it is evident that the moving of the said pins forms a very practical means of regulating the depth of ploughing.

As soon as traction ceases, the chain being no longer stretched, the action of the springs alone is effective, and the supports leave their inclined position and take up a vertical position, at the same time bringing back the axle of the plough to its back position or position at rest.

This change in the inclination of the supports has the effect of raising the frame of the plough causing automatically a partial unearthing of the ploughs. The bringing back of the axle, and consequently of the wheels, to an extreme backward position, brings back the line of support of the plough under a point near to its centre of gravity. It results that a large part of its weight passes in front of that line and that it becomes lighter behind and consequently easier to turn.

In conclusion the Desprez dynamometer may be noted, a simple and strong apparatus with which it can be ascertained when the tractor is about to furnish its normal force and avoid overworking it.

AGRICULTURAL INDUSTRIES

945 – **Wine Makng in the Province of Mendoza, Argentina.** — See No. 923 of this *Review*.

946 - **The Use of "Wood" Wool for Filtering Wines.** — MARESCALCHI, A., in *L'Italia vinicola e agraria*, Vol. XI, No. 10, pp. 148-149. Casale Monferrato, March 6 1921.

The "wood wool" generally used in packing is made from very thin, fine shavings of soft wood (poplar or willow).

For the last 5 years, owing to the law prohibiting the use of pomace for filtering wine beyond the limits fixed by the prefects, the use of these shavings as a filtering material has become very common in Italy. The method of preparing it, which has been improved by M. Angelo Pansera, is as follows:— The thin shavings are well beaten to free them from dust, and then soaked in water for at least 2 days, the water being renewed daily: the water is alloved to drain off, and the shavings pressed. Then they are are put to soak for 2 days in water to which 500 gm. of tartaric acid per hectolitre have been added. Finally, the shavings are pressed, and afterwards they are ready for use. They are placed in the vat and pressed down in such a way as to come only a little above half its height (5 or 6 kg. are required per hectolitre of the capacity of the vat), planks being placed on the top to keep them under pressure. The filter thus prepared is used just as if it was pomace. It lasts for years, as after washing, it can be employed again, for it does not ferment in the summer, become sour, or alter in any way. Its use imparts absolute clarity to the wine. This filter can also be adopted for musts and vinegar, or for the first filtering process during the usual time the pomace is kept. It is advisable to make two filters, one for wines with a good deal of sediment, and the other for ordinary wines in general use.

947 - **Results of Experiments Carried Out in Italy at the University Scientific Laboratories on Specimens submitted to Them by the National Scientific and Technical Committee for the Growth and Development of Italian Industry.** — I. PERATONER A. (Direttore del Laboratorio di Chimica farmaceutica della R. Università di Roma). — II. PELLINI, G. (Direttore del Laboratorio di Chimica farmaceutica della R. Università di Palermo). — III. PIUTTI, A. (Direttore del Laboratorio di chimica farmaceutica della R. Università di Napoli), in *Bollettino scientifico-tecnico, Periodico bimestrale per gli Atti del Comitato nazionale scientifico-tecnico per lo sviluppo e l'incremento dell'industria italiana*, Year III, No. 2, pp. 72-73., Milan, March-April, 1921.

I. STUDIES OF THE PRINCIPLES CONTAINED IN PLANTS WITH MEDICINAL OILS IN SOUTH ITALY AND THE COLONIES. EXPERIMENTS ON THE CASTOR OIL PLANT. — In 1918-1919, the seeds of 40 varieties of *Ricinus* cultivated in the Royal Botanic Gardens of Naples were studied. In the first place, their oil content was determined, not only by means of extraction with ethyl ether, by also by pressure with, and without, heat. The following varieties yielded the largest proportion of oil:—

	Per cent.
Ricinus sanguineus (from Legnago)	56.085
» » local	56.47
» » from Vilmorin	55.45
» *Scafati* pale	54.475
» » red	53.795
» *Borboniensis*	52.605

In spite of their large oil yield, the following varieties are not to be recommended: —

Ricinus zanzibariensis dwarf	55.215
» » red	53.83
» » blood-red	52.245
» *Gibsoni* blood-red	55.05
» *viridis* (from India) pale	51.575

R. zanzibariensis, on account of its small production of seeds; *Gibsoni* because its capsules are dehiscent, and the seeds get lost, *viridis* as being a plant of inferior development and hence of low yield.

On the other hand, the *sanguineus* varieties and those cultivated at Scafati (both the red and pale kind) are strongly to be recommended. The *Borboniensis* variety, although apparently productive, is subject to fungoid disease, and should therefore be excluded.

In order to determine the purity of commercial castor oils, a method was then devised by which it was possible to estimate very easily and rapidly the amount of ricinolein they contain. On allowing phosgene (carbonyl chloride), to bubble gently through oil heated at 100°C., it reacts quantitively and gives a trichlor derivative of ricinolein, insoluble in alcohol, differing in this respect from castor oil, and heavier than water. This chlor-derivative is easily separated from the dissolved phosgene, if heated to 50-60°C., and the absorbed chlorine is then determined by the PIRIA-VOLHARD method. If castor oil were entirely composed of ricinolein, the theoretical amount of chlorine (chlorine index) would be 9.49 %; in practice it varies in oils taken from different varieties of *Ricinus* between 8.9 % and 9.2 %. Other oils (those from olives, almonds, cotton, sesame, groundnuts, etc.) fix amounts of chlorine varying between 0.08 % (almonds), and 0.19 % (groundnuts), therefore their addition to castor oil decreases the chloride index proportionally. The method has been tried with good results on artificial mixtures of different oils and castor oil.

Oil from thorn-apple seed (*Datura Stramonium*). — This is obtained by extraction with carbon disulphide and ether; in both cases, the yield varies round about 25 %, but the oil especially when extracted with ether, contains a certain amount of daturin (atropin) which renders it very active biologically. It is being used experimentally at the present time in several clinics for diseases of the eye and in one medical clinic.

Otto of Roses. — Some varieties of rose were grown for their essential oil by Prof. CAVARA at the Royal Botanic Gardens of Naples. Excellent results were obtained from the flowers of *Rosa Hayi* and *Rosa Brünner* by extraction with petroleum ether. An oil with very strong scent was procured by first freeing it from the wax by means of absolute alcohol and evaporating the latter in a vacuum. Anticaïn can also be easily extracted from *Rosa Hayi* which can be well substituted for the sunflower in laboratories.

Other essential oils. — These have been obtained from the seeds of fennel (*Foeniculum* sp.), the leaves of balm (*Melissa officinalis*) and the leaves of bay (*Laurus nobilis*) ; a large number of other plants are being studied such as foxglove (*Digitalis* sp.), marjoram (*Origanum* sp.), lavender (*Lavandula* sp.).

II. STUDIES ON THE PRINCIPLES THAT CAN BE EXTRACTED FROM THE MEDICINAL AND PERFUME PLANTS OF SICILY. — The experiments began by distilling the essential oils obtained. The following plants have been studied :— *Origanum siculum* (var *Bentham*) ; *Ruta bractosa ; Myrta communis ; Eucalyptus Globulus ; Mentha Pulegium* (var. *hirsuta Gussonei*) ; *Calamintha Nepeta ; Santolina Chamaecyparissus ; Chenopodium multifidum ; Rosmarinus officinalis.*

One fact worthy of mention is that the essential oil of the Sicilian marjoram which grows wild in many parts of the island is largely used there as a condiment. The variety examined contained 49.5 % of phenol (entirely consisting of thymol except for traces of a phenol which was not identified). About 98 % of the essential oil of *Ruta* consists of methylheptylketone and methylnonylketone, the former predominating (it makes up about $^2/_3$ of the whole).

III. — STUDIES ON THE JUICE OF CITRUS FRUITS AND ITS MORE SYSTEMATIC COMMERCIAL UTILISATION. — The object of these researches was to study the best means of keeping the fresh juice (to be used as a food or beverage) in a condition suitable for export and to devise a suitable method of collecting and purifying it.

In order to preserve the juice of lemons none of the usual chemical anti-ferments must be employed as the Italian Health Regulations prohibit their use. The only anti-ferment allowed, sulphurous acid, imports an unpleasant acidity to the juice. Sterilisation by heat in an autoclave and pasteurisation give the juice a boiled taste that prevents its use as a beveragé. An attempt is to be made to by hydrogen peroxide and ozone.

Satisfactory results are apparently obtained by concentrating it in a vacuum at temperatures not above 50°C.-60°C., a concentrated extract representing from $^1/_8$ to $^1/_{10}$ of the juice being produced. It is a dense, yellowish liquid of the consistency of honey, which whep poured into moulds, sets in a gelatinous mass

If some grammes are dissolved in a glass of water the solution has the pleasant flavour of fresh juice.

The sterilisation of lemon juice by means of ultraviolet rays has also been attempted.

In the commercial preparation of this juice, the present methods of pressing the fruit must be abandoned. For this reason the author has been led to study a new treatment of the fruit, with a view to removing by mechanical means the superficial coloured external portion of the fruit alone. This contains the oil-bearing glands and the essential oil. The white part of the cortex is left untouched as far as possible.

Microtome sections of the outer cortex have been made and the thickness of the oil-bearing layer thus determined.

The fruit after this thin, external layer is removed, is cut in the direction of its short axis into two equal halves. The knives used for the operation are of silver, or heavily-plated metal, bronze, phosphorised aluminium, or of horn.

The juice is not extracted by a press, but with a special mechanical apparatus consisting of rotating glass lemon squeezers. The remains of the lemons are put into an ordinary press to extract the remaining juice. The lemon juice is then filtered, in a stone-ware centrifugal filter, not a filter-press. A knitted cloth, not a woven cloth, is used for filtering. The receptacles containing the juice must be of stone-ware, and the tubes must either be of stone-ware, glass, or commercial fused quartz.

If a concentrated extract is needed, the copper bowl should be heavily plated with silver, not tinned.

948 - **Paper Pulp Supplies from India. I. Chemical-Enquiry. II. Preparation of Bamboo Prior to Digestion.** — RAITT, W., (Cellulose Expert to the Government of India, attached to the Forest Research Institute, Dehra Dun, India), in *Journal of the Royal Society of Arts*, Vol. LXIX, No. 3579, pp. 509-517. London, June 24, 1921.

The Indian Forest Research Institute has made a careful study of the paper pulp question and amongst all the various plants suggested as utilisable for paper manufacture, has found so far that only 2 small groups, both belonging to the Gramineae are economically sound as regards the quantity and quality of their cellulose and the manufacturing conditions under which they can be exploited. These are bamboos and Savannah grasses. The author estimates that taking everything into consideration, Burma, Bengal and South-West India could produce 10 million tons of pulp per annum, and Assam 3 million (from Savannah grasses). The possibilities and present state of affairs as regards bamboo cultivation has been described by PEARSON in *The Indian Forester*, Volume XLVI, Nos. 11 and 12 (1). The author in the present paper confines his statements chiefly to the chemical side of the question, and the problem which interests the paper manufacturer, namely, the getting into solution of the non-cellulose constituents of his raw material.

The preparation of bamboo prior to digestion has given rise to some difference of opinion, and the author draws attention to the physical and constructional features associated with bamboo and the consequent effect of crushing or chipping, the two preparatory treatments now in vogue. The fibre brindles of bamboo lie perfectly parallel to each other with no cross graining and interlacing; they split cleanly and crush perfectly without reducing to dust. Groups of sap canals are abundant, which run parallel thoughout the whole length of the stem. In the dry material these are filled with air, which being in a state of capillarity is extremely difficult to dislodge, and in the case of chips, offers a powerful resistance to the penetration of liquor, besides adding to the buoyancy of the mass and tending to float a portion of it above the liquor. The splitting which is the first effect of crushing, runs along these canals which are thus laid open to attack by liquor on their interior surfaces and the capillary air is eliminated : wood presents no such feature.

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(1) See *R.* May, 1921, No. 498. (*Ed.*)

Throughout the entire length of stem, bamboo is of homogeneous, one-aged one season growth and therefore must not contain differences in density and quality. In wood there must be a proportion of indigested chips in wood pulp digestion, but there is no need for this in the case of bamboo. The nodes, contrary to general belief, are not denser than the internodes. Their specific gravity is about 5 % less, but they contain more pectose and lignin and their colloidal resistance to liquor penetration is, therefore, greater. The antidote to this is by opening up their tissues completely. By crushing, this can be done so thoroughly that they can scarcely be distinguished in the general mass. As chips they must result in a considerable proportion of undigested specks and blemishes in the pulps.

The author draws attention to one peculiar feature of bamboo relative to which a warning should be issued, viz. the extraordinary phenomenon it exhibits of cyclical gregarious seeding and death. A factory planted in a district without some inquiry having been made as to the seeding cycle, might find itself suddenly bereft of supplies for a prolonged period. There are 2 methods recommended : first, the next seeding period may be known to be at such a date that supplies can be depended upon for a period long enough to secure an ample return in capital invested in the undertaking, and second, the presence in the area of an alternative species which, as is invariably the case, does not flower at the same period.

949 - **Manufacture of Tobacco Shade Cloth.** — Cox, J. W. in *The Textile World*, Vol. LIX- No 21, pp 41-42, figs. 4. New York, May 21, 1921

It has been recognised for some time past that a suitable shade should be provided to protect wrapper leaf from the sun. Many things have been tried and found unpractical for various reasons, and cotton cheese cloth, netting and osnaburg were used on experimental patches. These, however, did only fairly well, and eventually certain cotton manufacturers evolved the present tobacco shade cloth, which is cheap and is found far more advantageous than anything previously suggested. This article explains in general its uses and manufacture.

950 — **The Far-Eastern Lac Industry in France** (1). — Verneuil, P , in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXX, Vol 133, No 2, pp 179-192, figs 8. Paris, February, 1921.

The lacs of the Far-East, which are not connected in any way with the varnishes known as " laques " in France, or with "gum lac " (or " stick lac "), an animal product derived from the secretions of coccids, are of purely plant origin, being latexes obtained by tapping from various trees cultivated in China, Japan, and Tonkin. Although these trees are now less grown in Japan and China, they are increasingly cultivated in Tonkin, which has for a long time been the only country in the world that exports lacs, some 2500 tons of this product being exported each year.

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(1) See Lac-Yielding Trees of Indo-china and their Products, *R.*, Feb , 1919, No. 207. (*Ed.*)

Lac is increasingly employed in modern industry, being largely used in aviation (as a protective cover for propellers, etc.), and also in electricity (being unequalled for its insulating properties).

The author studies in succession, the lac-tree of Tonkin (*Rhus succedanea*); the tapping of the latex and preparation of the lac; the native processes connected with its application, which are long, tedious, but very well executed; the physical and chemical characters especially the question of its hardening when exposed to cold and to heat); and its use in modern industries.

Lac has wonderful qualities which render it of paramount importance to industry, but the archaic operations connected with its use, hand-mixing, laying on with a brush, and the endless rubbing down and polishing, are bound to be superseded. They are ridiculously slow and tedious, even in the Far-East, where, at all events in appearance, labour is cheap, and would be an impossible anachronism in France. Such processes absolutely prevent the commercial use of lac.

If this substance is ever to be of any practical utility in industry, it will have to be prepared mechanically. Fortunately, mechanical kneaders have been devised that will answer their purpose very well, and an aerograph system of applying the varnish has been invented. The instrument is a substitute for from 10 to 20 experienced varnishers, according to the extent of surface to be treated. It has finally been announced that rubbing down machines can be had to reduce the endless work of rubbing down propellers and furniture. The author is testing a method for varnishing barrels and all other receptacles with small orifices, which will certainly give excellent results.

951 - **Present Position of the Camphor Industry throughout the World and Notes on Methods of Cultivation Employed** (1). — I. Present Position of the Camphor Industry. *Bulletin of the Imperial Institute*, Vol. XVIII, No. 4, pp. 524-536. London, Oct.-Dec. 1920. — II. Camphor Production and Exports in Japan. *Board of Trade Journal*, Vol. XIV, New Series. No. 1216, p. 400. London, March 18, 1920.

I. The effect of the Japanese monopoly has been to encourage the production of natural camphor in various countries, and has stimulated the efforts to solve the problem of the profitable manufacture of synthetic camphor. Hitherto it has not been found profitable to produce the latter on a commercial scale in competition with the natural product, but the American camphor refiners are seriously considering the desirability of developing the manufacture of synthetic camphor (true synthetic camphor may be made by preparing borneol or isoborneol from pinene hydrochloride or hydrobromide, and subsequently oxidisingit.)

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(1) See *R.* May 1920, No. 528 and *R.* March 1921, No. 294. (*Ed.*)

The camphor difficulty is, however, not merely a question of the high price of Japanese camphor, but the almost complete absence of the product from the free markets of the world. The production of camphor from leaves (1) in Florida will alleviate the position to some extent so far as the American manufacturer is concerned, but strenuous efforts should be made to obtain supplies by the cultivation of the camphor tree in all countries suitable to its growth, and the home manufacture of synthetic camphor is distinctly advisable whenever possible.

The author gives details of the past and present sources of supply in Japan, Formosa and China, and the future possibilities both in these countries and methods of cultivation now in progress elsewhere in the United States, the British Empire, etc.

JAPAN. — The Japanese Monopoly Board are stated to have planted 3 000 000 trees between 1900 and 1906, and 11 000 000 in the 3 following years, and to have resolved from 1913 onwards to plant 3000 acres with camphor annually for 12 years. About 1270 trees are planted per acre. After 5 years experimental work, it was stated that leaf distillation was to be begun on a practical scale, and it was estimated that 6 500 000 lb. of camphor would be produced annually from these plantations. Although the average yield since then has varied, the yield anticipated for 1921 is from 6 615 000 to 7 938 000 lb. Whilst it is obvious that this yield, if realised, will not meet the world's demand for camphor, the restrictions upon exports imposed by the Japanese Government will permit only a very small proportion of the supply to enter foreign commerce.

II. According to the report issued in the *Board of Trade Journal*, which quotes the figures published in the *Yokohama Chamber of Commerce Journal*, the production of crude camphor and camphor oil respectively for the 7 years from 1912-1918 inclusive is given as follows: in thousand *kin* (1 *kin* = 1.323 lb.):—

1912: 5115 and 7073; 1913: 5576 and 7395; 1914: 5865 and 8388; 1915: 6220 and 9882; 1916. 6517 and 11 010; 1917: 4168 and 7857; 1918: 2740 and 5591.

The export of Japanese camphor to England, France and Germany before the war exceeded 1 million *kin* each, and to the United States was about 2 ½ million *kin*. The total quantity exported abroad about equalled the quantity consumed in Japan in celluloid and other manufacturing industries.

According to the figures, there is a gradual decrease in camphor export, especially to the United States and the quantity of camphor consumed in Japan has also decreased considerably since 1916 before which there had been a gradual increase. This may be explained by the shortage of supply and does not signify any decrease in the demand.

I. FORMOSA. — This is now rapidly becoming a manufacturing area rather than a region of production and export of the raw material, a trend which has been accentuated since the war started. In May 1920 all export of crude camphor was prohibited, a limited amount of refined camphor being allowed to foreign refiners at a discount of 3 % below the market price.

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(1) For percentage of camphor furnished by leaves and branches in various countries, see *R.* June, 1920, No. 646. (*Ed*)

ÇHINA. — The threatened monopoly not only of the camphor refining but also of the celluloid industry by Japan has naturally stimulated the search for other sources of supply of camphor or for substitutes for the manufacture of celluloid. American buyers are looking to China for an immediate addition to the supply. In the Shan States of southwest Yunnan there are stated to be an immense number of camphor trees only awaiting transport facilities for their exploitation.

The recommendation offered is that an American Syndicate should start operations in South Hunan and South Kiangsi, establishing distilleries on modern lines, cutting in a conservative manner, and encouraging planting by demonstration plantations, lectures, pamphlets, and free distribution of seed and seedlings; and should afterwards extend their action into Kweichow, Kwangtung, and Kwangsi. Experimental production from wild and planted trees is being carried out in the island of Hainan, and the native camphor oil which in China usually contains 60 % camphor is being bought up.

UNITED STATES. — The Celluloid Company have now planted 3000 acres at Satsuma, and the Arlington Company 12 000 acres at Waller (since 1914); and planting has also been carried out in Texas and in the San Joaquin Valley. California. The trees are doing well in poor sandy soil being sown thickly at first, and transplanted when a year old into rows 15-16 ft. apart and 3 ½-4 ft. apart in the rows. The leaves are cut 4 years after transplanting, new growth rapidly replacing the portion pruned, so that two prunings become possible within the year. The rows are ultimately trimmed into V-shaped hedges 7-8 ft. high; the yield of flush, is now estimated at 5 tons per acre per annum yielding from 125 to 150 lb. of camphor. A special station for the study of camphor has been established at Orange City (Iowa) and a trimming machine has been designed which prunes 6 acres per day (1). It has been found that young leaves contain more camphor than the 1 or 2 year old wood, so that no severe pruning is desirable; but, if the leaves are cut once or twice a year, it seems improbable that, as seems to be expected in Florida, the mature wood in later years can contain much camphor. Fallen leaves give a good percentage of oil and camphor, and it appears economical to air-dry the leaves before distillation, but rain or direct sun on the flush reduces the camphor content. For successful camphor cultivation a temperature not falling below 20° F and a rainfall of not less than 50 inches are two points worthy of notice.

There being every prospect of successful cultivation in the Philippinnes, the Government, has granted the control of a large area of suitable land there to an American Company.

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(1) See *R.* March 1921, No. 294. (*Ed*)

BRITISH EMPIRE :— a) *Burma :* — Plantations up to altitudes of 3000 ft. have proved successful, but at 4000 and 6000 ft. have failed.

However, the tree does well at Ootacamund in the Nilgiris at an altitude of 7300 ft. ; and has also grown well at Dehra Dun.

b) *Federated Malay States* — Experimental planting began in Selangor in 1904, and during the early years the growth equalled that in Japan.

The tree was however, found to be liable to attacks of termites *Attacus atlas*, *Fomes*, *Rosellinia bothrina* etc. It was possible, nevertheless, to begin pruning in the 3rd year, an acre of trees yielding about 5 tons of flush 3 times a year and the leaves, when air-dried, giving from 1.1 to 2.6 % of crude camphor. Assuming a yield of 1 %, 10 000 lb. of flush are required for 100 lb. of crude camphor, as against 15 400 lb. with a yield of 0.55 % from prunings of trees under 3 years of age. The cost of collection, distillation and shipping is estimated at 63s. per 100 lb

c) *Ceylon* — Being nearer the Equator than the natural range of the species, camphor did well between 3000 and 5000 ft. but not below 2000 ft. Lime and potash, were found to be necessary in the soil. The trees were coppiced to a height of 4 or 5 ft., and were found to yield 14 lb. of flush per annum each giving from 27 to 34 % of camphor oil and 0.75 to 1 % of camphor, which, with the trees 4 ft. apart in rows 8 ft. apart *i. e.* 1360 to the acre, should give 143-190 lb. of camphor per acre. Successful results have been obtained on a sandy loam where the rainfall is not less than 90 in., where the trees have been planted in hedges running across the direction of the prevailing wind.

Seed does not keep well in Ceylon, but may be stored in moist charcoal until May or June and is soaked for a day or two before being sown.

d) *Mauritius.* — A *Cinnamomum* sp. has grown well, but yields an oil very different from tree camphor oil, containing cineole, but no safrole and a little camphor.

e) *South Africa.* — Experiments suggest that camphor might be profitably cultivated in some of the warmer and moister parts of the Union territory.

f) *West Indies.* — There are two distinct unproductive forms of *Cinnamomum* and yet another form which gives a normal yield of 1% or more of camphor in Jamaica, Trinidad and Dominica. Obviously the inferior varieties should not be allowed to hybridise with the true variety and should as far as possible be eliminated.

g) *Australia.* — *C. Camphora* is commonly grown in Queensland, and a native species *C. Olivieri* is stated to contain camphor, but requires further examination ; and in the Young district of New South Wales, a 15 year old tree gave 1.02 % camphor from its fresh leaves, a result comparing favourably with those obtained in Florida and elsewhere. It is suggested that the leaves might advantageously be distilled for the crude products on the bush with a similar apparatus to that employed for the Eucalypts.

Giving a return after 3 or 4 years the crop is far less speculative in character than if planted for wood distillation after the lapse of from 15 to 60 years.

OTHER COUNTRIES — Reference is made to the cultivation in the Straits Settlements, Madagascar, the Canaries, Buenos Aires, Algeria and also in Italy (1) where on the shores of Lago Maggiore, a tree has reached 90 ft. in height and 1 ft. in diameter within 8 years from the time of sowing, a height rarely reached in a century, and a diameter usually requiring 25 years growth.

It is therefore clear that the camphor tree can be successfully grown in many countries and if care be taken to secure the true form, a small but constant yield can be obtained by the distillation of leaves, etc. which at prices considerably below those now general, will be amply remunerative, and there are evidently great possibilities in the future quite apart from the old recognised sources of supply in Japan and China.

952 - **Nitrogen and Other Losses During the Ensiling of Maize.**— SHAW, R. H., WRIGHT P. A., and DEYSHER E. F., in *United States Department of Agriculture Bulletin No.* 953 pp. 1-16, bibliogr. of 19 works. Washington, D. C. May 14, 1921.

For several years the Dairy Division of the United States Department of Agriculture has been studying to find out more definitely what losses incident to the ensiling of maize are necessary, and what is the proper method of handling the crop to prevent such losses. This bulletin deals with the losses of nitrogen and other elements in maize silage made under ordinary farm conditions.

A cylindrical concrete silo was employed 42 ft., high × 14 ft., inside diameter, holding approximately 150 tons, and located at the Dairy Division Experiment Farm, Beltsville, Md. The floor was 4 ft. below the lowest door and the silo up to this door was water tight. The experimental work was carried on for 2 seasons, 1914-15, 1915-16. The depth of the silage after settling was approximately 38ft.

The weight and chemical composition were recorded of: 1) the maize in each sack as it was buried; 2) the contents of the sacks as they were moved from the silo; 3) the juice. The losses or gains in each sack were estimated, based on the weights ensiled.

The results of the chemical analyses as given in the Tables, show many evidences of a down-wash of soluble material, the upper part of the silo losing and the lower part gaining. The greatest loss of dry matter in any bag in 1914-15 was only 18.64 %, while the average loss for all the bags was 8.66 %. The bags in the upper and lower halves of the silo showed respectively, 12.74 % and 4.70 % losses in dry matter. The apparent reversal of results in the following season may be attributed to the much larger outflow of juice. The average loss for all bags, however, from the 2 year's work, may be taken as nearly 10 % of the dry matter, which is probably due to a large extent to the fermentation of the carbohydrates and to the carrying away of a soluble material by the juice. The reducing and non reducing sugars almost entirely disappeared. There was a considerable loss in crude fibre and in the furfurol yielding bodies.

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(1) See *R.* June 1920, No. 646. (*Ed.*)

The evident loss in total nitrogen may be due largely, if not entirely, to the nitrogenous compounds which escaped in the juice. The albuminoid nitrogen suffered a loss of over 50 %, while the non-albuminoid forms increased several times their own weight.

If the total nitrogen of the 2579 lb. of juice collected in the first season is expressed as pure protein, the loss was 28.89 lb. which represents the protein in about 1500 lb. of. average silage. In the second season, the results expressed in a similar way, show a loss of 150.75 lb. in the 9494.5 lb. of juice collected, representing the protein in about 7500 lb. of average silage.

There was a gain in ether extract, which is probably due to the formation of new ether-soluble bodies.

The juice which was collected the second season amounted to nearly 10 000 lb. This juice averaged 0.263 % total nitrogen, 0.0283 % albuminoid nitrogen, 317.9 parts ammonia nitrogen and 1472.9 parts amino-nitrogen per million.

953 – **Comparisons between Sun-Drying and Stack-Drying of Fruits** (1). — NFER, F. E, in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. X, No. 2. p. 71. Sacramento, Ca, Febr. 1921.

Report on experiments carried out at the University Farm, Davis, California.

Stack drying resulted in giving practically the same product obtained from evaporators. An apricot was cut in two and each part treated differently. All lots were exposed to the same amount of sulphur. At the end of 48 hours the sun-dried product was beginning to get in the condition when it should be stacked. At the end of 72 hours, the sun-dried was somewhat too brown, whereas the other was just about right. A better coloured fruit was obtained than the ordinary sun-dried product. It was not curled up at the edges and on slat trays it was turned out in less time. It seems advisable in stack drying, instead of putting the fruit directly in the stack, to expose it to the sun for a half-day, in order to get the colour produced by the sun, and then place it in the stack until dry. This saves a certain amount of moisture and gives a choicer product The sugar content seems to be practically the same but the eating quality of the stack-dried fruit is superior. Stack-drying should not be conducted with 3 × 8 ft., trays because the fruit may mildew before it is dry. It is advisable to use smaller trays whenever possible (2 × 3 or 3 × 3).

954 – **Method of Distinguishing an Egg Preserved in Lime Water from an Ordinary Egg.** — KEIS, K. and STUDINGER. J. (2) (Communication made by the Chemical Laboratory of the Canton of Bâle), in the *Annales des Falsifications et des Fraudes*, Year XIV, No. 151, pp. 148-151, Paris, May, 1921.

According to the " Manuel Suisse des denrées alimentaires, " the most certain way of distinguishing an egg which has been kept in lime-water from a fresh egg, is by determining the lime content of the ash of the albumen. The data given by the "Manuel Suisse" are based in Ivan RÖZSENYI's work entitled "On eggs preserved in lime" (*Sur les œufs à la chaux*). The authors subject this book to a critical examination, and also give the results of their own experiments.

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(1) See *R.* Aug. 1921, No. 858 (*Ed.*).

(2) Published in La Revue Pharmaceutique suisse No. 14, Feb. 1921 (*Ed.*).

From the tests carried out with the eggs from a single hen-house they obtained the following data:

No	Duration of immersion in lime-water	Ash	CaO of ash
1	fresh	0.75 %	2.64%
2	1 months	0.80	2.04
3	3 months	0.76	1.44
4	5 months	0.78	1.43
5	6 months	0.73	1.12

As can be seen, there is no increase in the lime content, even at the end of 6 months, and the percentage of lime is variable even in the case of eggs having the same origin.

The ash of the white of lime-preserved eggs from Croatia and Denmark was found to contain from 0.71 to 4.85 % of Ca O, with the exception of one egg with a cylindrical flattened yolk, and reddish albumen; this was probably a very old preserved egg, in which the white had become mixed with the yolk before it was opened, and which contained, as in the case of the eggs in RÖZSENYI's experiment, a very high percentage of lime.

These tests show that the amount of lime present in the albumen of fresh eggs is very variable: about 0.59 to 4.25 % of the ash. The lime content does not perceptibly increase, even if the egg is left for several months in lime-water, and the weight of the egg remains unchanged. Therefore the amount of lime in the white of an egg affords no means of judging whether or not the egg has been put in lime water.

The vitelline membrane of lime-preseved eggs is easily affected, after even a relatively short time. For this reason, the authors are of opinion that, as the lime content of the yolk is much higher than that of the white, the high figures obtained by RÖZSENYI are due to a little yolk having been mixed with the white, owing to the rupture of the vitelline membrane when the egg was broken.

If this membrane is fragile, an egg can be considered as not fresh. It is well-known that the specific gravity of an egg that has been kept in the air shows whether it is fresh or not. In the case of eggs with an easily ruptured vitelline membrane, the specific gravity will not indicate whether they have been preserved in lime, but will show that they have been preserved in some liquid, or kept in the air, the specific gravity in the latter case being much lower than in the former: the specific gravity of eggs preserved in a liquid remains invariable.

PLANT DISEASES

GENERAL INFORMATION

955 - Organisation and Development of the Bureau of "Sanidad vegetal" of Cuba.

— *Communicated by* Dr. F. F. Falco, *Delegate of Cuba to the International Institute of Agriculture.*

The history of the Phyto-pathological Service of Cuba is of comparatively recent date, but it is only just to state that the Service has developed very rapidly and uninterruptedly. As soon as the Republican Government came into power, a small Phytopathological Service composed of honorary members was instituted for the purpose of studying certain questions of Phytopathology and Entomology specially connected with the export and import trade. Neither this Commission, however, nor the larger one appointed later, was capable of coping with all the problems requiring solution.

In 1916, as a result of the careful enquiry instituted, subsequent to their many scientific expeditions, by Professors John R. Johnston and Patricio Cardin (at that time chiefs of the Departments of Phytopathology and Economic Entomology of the Agricultural Experiment Station of Cuba), the urgent necessity was felt of adopting the most speedy, practical and efficacious means for the control of certain injurious insects and diseases that are so prevalent as to constitute a veritable calamity to national agriculture, and at the same time of instituting a severer and more thorough supervision of the transport of plants and plant products, not only within the boundaries of the national territory, but also when they enter and leave the country. To this end, the Ministry of Agriculture, in conjunction with the President of the Republic, appointed that same year a "Commission of Plant Health" composed of a President, Dr. John R. Johnston, a Secretary, Dr. Mario Sanchez Roig, and one member, M. Patricio Cardin.

Three inspectors, an Office staff, and workers were also appointed. This Commission commenced its work by devoting itself especially to the study of the problem which then appeared the most pressing, viz., the destruction of the "mosca prieta" (*Aleurocanthus woglumi*) (1) which was doing serious damage to the citrus and other fruit trees of great economic importance cultivated in the east province. About the same date, the Commission instituted investigations into the Panama disease (2) that attacks different varieties of bananas, especially in the region of Artemisia. Further, at Baracoa, the centre of coconut cultivation in Cuba, where a terrible disease known as coconut bud-root (1) was decimating the plantations, the first steps were taken to isolate the centres of infection and thus hinder the spread of the epidemic.

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(1) See *R.*, Oct., 1918, No. 1186. (*Ed.*)

(2) See *R.* Jan. 1911, No 329; *R.* May 1911; No, 1549; *R.* Dec, 1912, No. 1686 (*Ed*)

The results of the first efforts of this Commission were such as speedily to convince the authorities of the country of the necessity of continuing and extending the work, which was greatly appreciated, both by the agriculturists and fruit-growers of Cuba. Therefore, the said Commission was converted into a larger institution called the " Bureau of Plant Health . " From that time, larger sums were allocated in the State budget for the use of this Bureau, its expert Staff was increased, the organisation of the Service was arranged so as to allow it to deal with the problem requiring most attention, its premises were enlarged, and it was provided with the necessary disinfecting apparatus, means of transport, and a fine laboratory.

The following datails relate to the organisation of the Bureau of Plant Health, which has continued to work in a perfectly normal manner.

THE CENTRAL BUREAU. — At the head of the entire organisation has been placed a Bureau with its headquarters at Havana. In order that the general work may progress faster, and be better distributed, the management has been entrusted to two persons, one being Prof. JOHN R. JOHNSTON, Chief of the Bureau of Plant Health, who orders and directs all operations of a scientific nature and devotes himself generally to all questions of technique, and the other, M. FELIPE DE LA CRUZ, chief of section and Staff, who attends to the administration, and matters connected with the Staff.

In addition to the various staffs employed in book-keeping, registration, statistical work, and the archives, the Bureau has technical experts employed in the following sections:—

PORTS, RAILWAYS, AND POSTAL SERVICE. — To this section is entrusted the supervision of all plants or plant products introduced into the country. It also supervises the despatch of plants and fruit to markets from places where quarantine regulations have been, or are about to come, in force, as regards the said plants and fruit. At the same time, it enforces the regulations and quarantine measures decreed by the Government of Cuba respecting certain foreign plant products.

GARDENS AND NURSERIES. — With a view to keeping all commercial market-gardens free from any serious diseases, the said gardens are regularly inspected, and if found in a satisfactory condition, are granted a certificate valid for certain time, and permitting plants to be despatched therefrom without further preliminaries.

This inspection of the gardens and nurseries is of great scientific importance to Cuba, for the reports drawn up give a list of all the insects and plant diseases that have been observed, and the data thus collected will serve as a basis for the general and detailed entomological and phytopathological map of the country.

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(1) See *R.*, Dec., 1910 ; *R.*, March, 1912, No. 598 ; *R.*, Oct., 1914, No. 961 ; *R.*, Jan., 1916, No 116. (*Ed.*)

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INSPECTION SERVICE. — Any person wishing to transport plants or portions of plants, from one place to another must obtain a certificate of good condition from the Bureau of Phytopathology, granted after due inspection. This service exercises constant supervision over all exported fruit packed before despatch, in order to prevent any leaf, or branch, leaving the country which is infected with pests, or diseases, that might entail quarantine measures being enforced against Cuban products.

ENTOMOLOGY, PHYTOPATHOLOGY, LABORATORY, AND MUSEUM. — A phytopathological laboratory is attached to the services of the Department, where, all the parasites collected during expeditions, or on special or general missions of enquiry, are classified and those sent by agriculturists when applying for advice. There is also a small museum containing specicimens of the insects and diseases collected by the scientific staff in the course of their excutsions and inspections. This museum which adds to its collection every day, is a very useful auxiliary in the work of determining and identifying insects, diseases, fungi, etc.

EXCHANGE. PUBLICATIONS AND LIBRARY. — The " Bureau of Plant Health " exchanges its publications with the scientific societies and Institutions of nearly all the countries in the world. Thanks to its Department, a movement for popularising and disseminating useful knowledge regarding plant diseases has been started throughout the country by means of bulletins and circulars in the form of books and pamphlets, or by the agency of newspapers and reviews.

The principal works published by the Bureau are as follows:—

Bulletin No. 1 (book) — La Comisión de Sanidad vegetal y su labor (The Commission of Plant Health and its work).

Bulletin No. 2 (book) — Algunas plagas de nuestros cultivos por Rodolfo ARANGO (Some of our Crop Pests).

Circular No. 1 (pamphlet) — La mosca prieta y medios para combatirla (The Black Fly and means for its control).

Circular No. 2 (pamphlet) — La enfermedad del cocotero (The Disease of the Coco Palm).

Circular No. 3 (pamphlet) — La enfermedad del plátano. (The Disease of the Banana).

Circular No. 4 (pamphlet) — La Plaga " salivita " en la yerba " Paraná " (The " salivita " Pest on the Paraná Plant).

Circular No. 5 (pamphlet) — Disposiciones vigentes sobre el servicio de Sanidad vegetal (Measures in Force Regarding the Plant Health Service).

Circular No. 6 (pamphlet) — La enfermedad " mosaico " de la caña de azúcar por John R. JOHNSTON (Mosaic Disease of the Sugar-Cane.

These publications are supplied gratuitously to subscribers, and in general, to all applicants.

ZONES OF WORK. — In order to be able better to carry out all the practical work within its sphere of action, which consists in the extirpation of pests, plant surgery, etc., the Bureau of Plant Health has mapped out zones of work. It has separate Stations in the districts where the worst disease centres are situated, and the duty of the various Staffs is to take all the prophylactic measures recommended by the Directors of the Bureau of Plant Health in special cases.

PROVINCIAL INSPECTORS. — In each Province, the Bureau is represented by an Inspector, whose work includes supervising plant-transport, and settling all matters connected with the affairs of the Bureau.

CHIEF PROBLEMS. — One the principal questions that has occupied the attention of the Bureau of Plant Health since its institution, is the extirpation of an insect popularly known as " mosca prieta " (the black fly, *Aleurocanthus woglumi*), a parasite that is very injurious to various fruit-trees, especially the citrus trees, etc., that constitute one of the country's most important sources of revenue, and the mango, which ranks next in economic importance.

A disease that for many years, has greatly reduced the coconut production of the island and of several regions of the American continent — " pudrición del cogollo del cocotero " (coconut bud-rot) — is also a problem to which the Department has devoted much attention. Gangs of workers are kept to disinfect the zones where the coconut palm is most intensively cultivated, and they have succeeded in checking the progress of this much-dreaded epidemic.

From the centre to the west of Cuba, the majority of the varieties of banana are very subject to what is known as the Panama disease, produced by a fungus of the genus *Fusarium*. This disease makes it very difficult to grow dessert bananas such as Johnson and Manzana.

The Bureau carries out special prophylactic measures suitable to this case, and exercises supervision on the transport of banana cuttings from one place to another, so as to prevent the spread of the malady. In this manner, it has been possible to confine it to one part of the island, leaving the eastern portion, quite immune. This has just been officially confirmed during a tour of inspection carried out by one of the members of the Agricultural Experiment Station of Cuba.

A sugar-cane disease called " mosaico, " " rayas amarillas " and " matizado " found in Java and Hawaii, has also been recorded at Porto Rico (1), where it causes great damage. A little later, its presence was observed in the sugar-cane zone of the United States, whence it was doubtless introduced into Cuba, where it has been reported from various places a long distance apart.

The Bureau of Plant Health, threatened by an outbreak of this disease, which would have been disastrous to the sugar crop, the most important source of the wealth of the island, and being well aware of the danger of the spread of the disease, exercised the most rigorous supervision, with the hope of entirely eliminating it. To this end, it keeps in contact with a large number of the sugar growers of the Republic with whom it exchanges observations, and is thus informed of all details which can serve as a basis for the serious and practical study of " matizado ".

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(1) See *R.*, May, 1919, No. 655; *R.*, June, 1919, No. 785; *R.*, 1920 No. 698. (*Ed.*)

One matter of recent date, and of great importance to the agricultural interests of Cuba, is at present occupying the attention of the Bureau of Plant Health, namely the means of preventing quarantine being imposed by the United States upon plant products imported from the island. As these measures are directed against the possibility of infection being conveyed by a diseased leaf, or portions of leaves, owing to the want of cleanliness of the ferry-boats, the Bureau of Plant Health has pledged itself to the Agricultural Department of Washington to guarantee the immunity from black fly of all plants liable to the attack of this parasite and growing on a radius of 200 feet on either side of railway traversed by the trucks engaged in the ferry-boat service.

956 - **Entomological Branch, Department of Agriculture, Canada.** — See No. 822 of this *Review*.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

957 - **Diseases of Cultivated Plants in the Cape Province, South Africa.** — PUTTERILL, V. A., in *Union of South Africa, Journal of the Department of Agriculture*, Vol. II. No. 6, pp. 525-532, figs. 6. Pretoria, June 1921.

Observations relative to diseases which attack certain plants in the Cape of Good Hope Province.

1) " Chlorosis," observed at Wellington in October 1920 on numerous plum trees (var. Kelsey), 12 years old; apricots in the same orchard were also attacked but less severely than the plums. The disease appeared in this case to be due mainly to the general lack of nutrition for the plants and of organic matter in humus form and possibly also to lack of iron.

2) " Lithiase " of pears: according to reports in May 1920, the fruits of about 200 pear trees 20 years old (var. " Bon Chrétien ") were attacked at Somerset West during the last two or three years. In 1919-1920 the attack was especially severe; about 15 % of the fruits of the above mentioned trees were injured. The soil had not been well drained up to last winter and in addition to this, last year it was particularly dry which explains to a large extent the spread of the disease.

3) *Rhizopus nigricans.* This caused the very serious rotting of peaches (var. Sea Eagle) packed for exportation ready for shipment to Stellenbosch. The same fungous was also found with *Penicillium italicum* on plums and peaches stored for some time. As regards control measures, it is recommended that the fruits be handled with the greatest care and damage round the peduncle should be avoided at picking time. On no account should fallen fruits be allowed to rot under the trees and

if impossible to utilise, they should be collected and burnt. It is probable that insects play an important part in the propagation of the parasite.

4) Chrysanthemum rust (*Puccinia Chrysanthemi*), fairly common in 1921 on chrysanthemums at Sea Point. This disease can be checked when the plants are only slightly injured, by picking off and burning the diseased leaves; plants very severely attacked should be burnt; Bordeaux mixture may be used with advantage as a spray for unaffected plants in order to prevent the spread of this disease.

958 - **Treatment for Rejuvenating, Olive-Trees, Vines, and Fruit Trees in General.** — LOTRIONTE, G., in *La Nuova Agricoltura del Lazio*, Year IX, No. 190, pp 28-29. Rome, April 1, 1921.

This treatment for restoring the vigour of trees and shrubs (olives, vines and fruit-trees) is especially efficacious in the case of individuals weakened by age, lack of cultural care, the action of cold or frost, and the attacks of plant or insect enemies

It can, however, be applied with equally good results to young or middle-aged trees and shrubs, for it increases their vigour and productivity to a remarkable extent, and is indispensable for trees which not only show clear signs of organic weakness, but also have their trunks covered with mosses and lichens, that cause direct injury to their host, and at the same time, harbour pathogenetic microorganisms.

A complete treatment calculated to induce rejuvenation naturally includes a series of operations ranging from systematic pruning to suitable manuring, and the usual cultural works which must be executed with the greatest care.

In order to complete and increase the effect of the last-mentioned practices, the author advises a method he has used successfully for 20 years, viz., covering, or spraying, the plants, according to whether they are of low or high growth, with a mixture composed of sulphate of iron (5 kg.), slaked lime (5 kg.) and water (1 hectolitre).

This lime-iron wash is very adhesive, not removed by the rain, and prepared in precisely the same way as Bordeaux mixture.

In the case of trees in a very weak state and especially in that of old olives suffering from root-rot, it is most advisable to extend the treatment to the large roots. For peach-trees, lime-iron spraying is an excellent addition to the usual winter treatment (spraying with 3 % Bordeaux mixture), as it controls leaf-curl (*Exoascus deformans*), and other causes of want of productivity.

The best time for using the lime-iron mixture is at the end of winter, from the middle of February to the end of March, or the first few days in April, in any case, not before the leaves begin to bud. One application, repeated every two years is sufficient.

959 – ***Fusarium roseum*** **a Hyphomycete Injurious to Wheat in the Rice Growing Regions of Italy.** — NOVELLI, N., in *Il Giornale di Risicoltura*, Vol. XI, No. 7, pp. 103-105. Vercelli, July 31, 1921.

In 1921, many fields of wheat situated in the rice-growing regions of Italy were attacked by *Fusarium roseum* Link, which is regarded as being the conidial form of the ascomycete *Gibberella Saubinetii* (Mont) Sacc.

This disease (wheat scab or blight), was also very common in other parts of Italy during the same year, and caused losses in some fields estimated at 20 % or more.

Awnless varieties are most attacked; though " Gentil Rosso, " " Carlotta Strampelli, " " Cologna, " " Varesotto, " etc., also suffered severely.

As protective measures, the careful drying of the wheat before thrashing is recommended; the grain should also be sieved, in order to eliminate all infected, stunted seeds. The seed-corn should be changed, and the seeds carefully disinfected with a solution of copper sulphate.

960 – **Ergot (*Claviceps* sp.) Ascomycete Observed on Many Grasses in Australia.** — BIRMINGHAM, W. A., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt. 6, pp. 410-412, figs. 8. Sydney. June 2, 1921.

In February, 1921, the Manager of Bathurst Experiment Farm submitted specimens of Blue Grass (*Andropogon intermedius*) to the Biological Branch for examination. A sticky secretion was found associated with the panicles due to the presence of the sphacelial stage of *Claviceps* sp.

In March 1921, the Manager of Glen Innes Experiment Farm observed the following specimens attacked by *Claviceps* sp., the ergot stage being present in each case; wheat, rye, Hungarian or Awnless Brome (*Bromus inermis*), a Canary grass (*Phalaris minor*), Loietta rye grass (*Lolium multiflorum* var.), fescue, Tall (*Festuca elatior*), Giant (*F. arundicanea*), Hooker's (*F. Hookeriana*). All the later crops and late growth of grasses had been seriously infected whilst the early varieties and early growths of grasses were practically free.

Specimens of *Pollinia fulvum* and *Panicum bulbosum* attacked by ergot have recently been submitted to the Biological Branch by the Principal of Hawkesbury Agricultural College.

This fungus appears to be more prevalent in warm moist seasons. Some previous records of this fungus in Australia are: Hooker's fescue (Glen Innes Experiment Farm, 1914) and wheat and rye (Glen Innes, 1914). MC. ALPINE records it on Perennial rye grass (*Lolium perenne*) and DARNEL (*L. temulentum*) in Victoria, 1895.

961 – **Diseases and Pests of Coconut Palm in Porto Rico.** — See No. 912 of this *Review*.

962 – **Diseases and Pests of the Camphor in the Federated Malay States.** — See No 951 of this *Reviw*.

WEEDS AND PARASITIC FLOWERING PLANTS

963 - **Copper Sulphate in the Control of the Field Poppy in Wheat Fields.** — VILCOQ, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VII, No. 29, pp. 640-642. Paris, Juln, 27, 1921.

The results of experiments carried out for the purpose of determining whether copper sulphate had a strong toxic action upon the field poppy (*Papaver Rhoeas*), and if so, the strength of the copper solution required to destroy it.

Some plots of ground belonging to the Agricultural College of Chesnoy (Loire), in which the wheat succeeding mangels was infested with field poppy, were sprayed with increasingly concentrated solutions of copper sulphate (3, 4, 5, and 6 %).

By this means, it was found, that 3 % and 4 % solution had hardly any effect, but that *Papaver Rholas* is not insensible to 5 and 6 % solution ; the latter is the highest concentration that can be used for fear of damaging the wheat. A 6 % solution blackens and destroys the lower leaves of the poppy ; the plant, however, continues to grow, though less vigorously, and its development is but slightly hindered.

INJURIOUS INSECTS AND OTHER LOWER AMIMALS

964 - **Biological Studies on *Aphis rumicis*.**— DAVIDSON F, in *Bulletin of Entomological Research*, Vol. XII, Part. I, pp. 81-89, 6 figg. London, June, 1921.

The specific name of *Aphis rumicis* Linn. is applied by the author to the black aphis found in spring upon the spindlewood-tree (*Euonymus europaeus*), and later in the season, upon beans, poppies and numerous other plants. This insect has many synonyms owing to its polyphagous habits, but the name given it, in 1746, by Linnaeus has the right of priority. The chief synonyms are: *A. papaveris*, Fabr., *A. euonymi* Fabr. and *A. fabae* Scop.

As scientific literature contains no complete description of *A. rumicis*, the author though it well to give in his paper a detailed account, illustrated by figures, of all the different forms of this species.

The morphological description is followed by a sketch of the life-history of the pest based on many rearing experiments, and upon observations made in the open.

These experiments were carried on during 1913, and the first half of 1914 ; when they were interrupted by the outbreak of Great War, and not resumed until 1920. The author reserves to himself the right of publishing his results by degrees. He is of opinion, that a through investigation of the life-history of the species in question would throw much light upon the very difficult biological problems connected with the family of the *Aphididae*.

[963-964]

965 - ***Chalcis euthryrrhini* sp., Hymenopteron Parasitic. on *Euthyrrhinus meditabundus* a Beetle Injurious to the Mango, in North Queensland.** — DODD, A. P, in *Bulletin of Entomological Research*, Vol. XII, Part 1, pp. 67-68. London, June, 1921.

A morphological description of a new species of Hymenopteron, *Chalcis euthyrrhini*, of which some specimens were obtained in the neighbourhood of Cairns and Townsville (North Queensland), by breeding the curculionid beetle *Euthyrrhinus meditabundus* Fabr., which is injurious to the mango. Other individuals were reared on the dead wood of the latter tree, or captured on the dead, or dying, wood infested by the coleopteron.

966 - ***Dicrurus macrocerus.* Useful Indian Bird.** — FLETCHER, T. B., and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XVI, Pt. 4, pp. 359-364. 1 col. pl. Calcutta, July, 1921.

Dicrurus macrocerus Vieill. (" Black Drongo " or "King Crow ") is one of the most common and familiar birds occurring in all cultivated areas. This bird is found near dwellings; it accompanies cattle often perching on their backs, and also follows the plough all with a view to the capture of insects. The food consists almost exclusively of insects, and largely of injurious insects such as crickets, grasshoppers, moths, bugs and insect larvae

The nest is usually placed in a tree between April and August (usually in May in Bihar).

The Drongo is protected by law throughout the whole year in Delhi, in the United Provinces, Bengal, Assam and Burma. As it a most useful bird it deserves every protection and encouragement. The latter can be attained in the case of cultivated areas, by the provision of suitable perches for the birds to rest on.

967 - **Means of Preventing the Officinal Cantharides *Lytta vesicatoria* from Injuring Fruit Trees.** — LOTRIONTE, G., in *La Nuova Agricoltura di Lazio*, Year IX, No. 204, p. 77. Rome, July 10, 1921.

In certain provinces of central and south Italy, the officinal cantharides or " Spanish Fly " (*Lytta vesicatoria* L.) often causes perceptible injury to olive and many other fruit-trees by rapidly devouring the leaves and tender shoots.

The only means of defence hitherto employed has consisted in shaking the trees attacked very early in the morning, when the coleoptera, numbed by the cold of the night, fall to the ground, where they can easily be collected to be sold to the chemists.

By the advice of the author, this treatment has been superseded in Latium for some years past, especially in the case of olive trees, by applying a spray with an acid Bordeaux mixture base (1.5 kg. of copper sulphate and 1 kg. of slaked lime in 1 hectolitre of water), to which has been added lead arsenate (1.0 to 1.5 kg.). A single application made at the beginning of the invasion has always sufficed completely to free the trees, after some hours, from the insects.

By the time the olives are gathered, the slight traces of lead arsenate will have already disappeared from the surface of the fruits, so there is no fear of any toxic effects.

968 - ***Pulvinaria ornata* n. sp. Coccid on Citrus Trees in New South Wales.** — FROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt. 6, pp. 427-428, pl. 1, Sydney. June, 2, 1921.

Description of *Pulvinaria ornata*, n. sp., found in abundance in 1920 in all stages of development, on the foliage of a lemon tree near Sydney.

P. psidii and *P. tecta* are two allied species and *P. cellulosa* is even more closely related to the species in question.

An examination of plants in the vicinity of the lemon tree resulted in the discovery of foliage of *Pittosporum undulatum* thickly infested with these mealy bugs. It would appear, therefore, that *P. undulatum* is the original or natural host of this bug, from which it had migrated to the lemon tree.

969 - ***Oryctes rhinoceros* a Coleopteron Injurious to the Coconut Palm, in Goa, Portuguese India.** — DOS REMEDIOS FURTADO C. X., in *Govêrno Geral do Estado da India, Direcão dos Serviços Agricolas e Florestais, Boletim de Agricultura*, Year II, Nos. 1-4 pp. 82-85. Nova Goa, 1920.

The coconut palm is one of the principal sources of revenue in the Colony of Goa. Among the enemies of this tree, the coleopteron, *Oryctes rhinoceros* L. (1) occupies a very important place, although the serious damage done by this insect is, it appears, little known to the greater number of the coconut growers, being frequently attributed to another beetle *Rynchophorus ferrugineus* Fab. (2), which continues the destructive work of the first, frequently causing the rapid death of the tree attacked.

O. rhinoceros has a predilection for the tenderest parts of the coconut palm, and selects the terminal bud. If the tree is severely attacked, it soon appears sickly, and very quickly succumbs, the terminal bud perishing first.

The galleries excavated by *O. rhinoceros* in the interior of the tree help *R. ferrugineus* to effect an entrance, and this beetle is even more injurious, and dangerous, than its predecessor.

The natural enemies of *O. rhinoceros* assist in controlling it, but there are other means of destroying the insect, or of preventing its appearance, which are most efficacious when applied collectively by all the owners of palms, attacked by this pest. The dead trees must be felled without delay, and removed from the plantations. They should be cut open lengthwise, and the fibrous portion removed and burnt.

As the beetle is greatly attracted by light, it has been suggested that large fires should be kindled at night; practical experience has, however, shown the author that no satisfactory results can thus be obtained.

It is best, at the beginning of the winter, to dig trenches with a capacity of 8 " mãos cubicos " and to place upright in them 4 pieces of coconut stem. When the stems begin to decay, the adult female beetles are attracted out in August, and the larvae must be carefully destroyed. They make a good chicken food.

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(1) See *R.* Dec. 1915, No. 1367 *(Ed.)*.

(2) See *R.* July 1917, No. 696. *(Ed.)*

The author states that having once put into a vessel containing water, a few small fish and other refuse, with the idea of using them when decomposed as a manure for certain plants in his garden, he found after some days, that the vessel was full of beetles which had been attracted by the smell emitted by the decomposing matter.

In order to prevent the coleoptera taking refuge in large heaps of plant refuse, some kitchen salt, which has a repellent effect upon the insects should be mixed with the rubbish. It is a good plan to turn over the heaps to the sun in September and October, in this way, some of the larvae sheltering there will fall a prey to the poultry, and the rest should be destroyed by the farmer. All the other organic matter intended for use as a fertiliser in the plantations, ought to be treated in the same manner, for salt not only repels the beetles, but has a fertilising action upon the coconut palm. Some persons advise spraying the terminal bud of the palm with salt water, but this can only be done with the help of mechanical sprayers, otherwise the operation is both costly and difficult.

The larvae hiding in the galleries can be extracted with a piece of wire having a hook at the end; when the grubs are removed, a small quantity ($^1/_{10}$ litre of oil of turpentine or tar is poured into the galleries, and the entrance is closed with clay.

One general rule that ought never to be neglected is to keep the plantation extremely clean; this is in fact an excellent means of preventing, or minimising, the attacks of *Orycetes rhinoceros*, and of other enemies of the coconut palm.

970 – ***Euthyrrhinus meditabundus* a Beetle Injurious to the Mango in Australia.** — HILL G. F., in *Bulletin of Entomological Research*, Vol. XII, Part 1, pp. 63-66, figs 1. London June 1921.

Adult specimens of the Curculionid *Euthyrrhinus meditabundus* Fabr. used formerly often to be met with in the woody district to the south of Darwin (Northern Territory), and have frequently been obtained from the branches of two indigenous trees, and of *Anona* and *Poinciana*, as well as from those of two undetermined, ornamental, foreign trees growing in the Botanic Garden at Darwin. As a rule, there trees were not much injured, although the specimens of *Poinciana* sometimes suffered considerably. Mango-trees, although seriously attacked and sometimes destroyed by termites (*Mastotermes darwiniensis*), seemed to be avoided by *E. meditabudus*, even when growing in the immediate neighbourhood of infected trees belonging to other species.

Since 1919, however, the author has had the opportunity of studying, at Townsville (North Queensland), the life-history and habits of this beetle, and has found, that it is a formidable enemy of the mango, a tree which although it is not much cultivated from the commercial standpoint, is nevertheless a frequent denizen of many gardens in North Queensland, where it is greatly prized, not only for its beauty, and the shade it affords, but also for the fine crops of fruit it produces.

The first symptom that shows the tree to have been attacked is the withering of the terminal branches; this is followed by partial defoliation, the growth of groups of leaf-bearing adventitious shoots along the primary and upper branches, and the death of the secondary, and subsequently, of the primary branches. The cause of these alterations is only revealed when the adult beetles begin to emerge from the dead, or dying, branches, or even though this is of rare occurrence, from the branches in which the sap continues to flow.

The young larvae, which hatch out from the eggs deposited by the females in shallow cavities, excavate galleries in the cortex, and afterwards in the sap-wood. These galleries first run, either obliquely, or horizontally, but sooner, or later, assume an entirely horizontal course. The damage usually done by the larvae is so great, that the branch is destroyed before the first adult insects emerge.

The cortex of a badly attacked branch is covered with holes of different sizes; those up to 2 mm. in diameter are made by the adult forms of the parasitic hymenoptera, which when in the larval stage, destroyed the larvae of *E. meditabundus*, whereas the largest (which may be as much as 7 mm. in diameter), are the work of the adult beetles.

E. meditabundus is not exempt from the attack of parasites of which the following have been identified: *Chalchis euthyrrhini* Dodd n. sp. (1), *Thaumasura curculionis* Girault, and *Th. pavo* Girault. None of these parasites have, however, proved themselves of much practical utility.

No experiments have yet been made in the artificial control of *E. meditabundus*. In the meantime, it seems reasonable to suppose, that the infested area could be restricted by cutting down the trees which are much attacked (and therefore useless) and burning them before the adult insects emerge.

971 - *Chermes cooleyi* Aphis on the Douglas Fir *Pseudotsuga Douglasii* in England and Scotland.— CUNLIFFE, N., in *Quarterly Journal of Forestry*, Vol. XV, No. 3, pp. 157-159. London, July, 1921.

Chermes cooleyi Gill has been introduced into England from North America within the last few years, almost certainly on imported trees. Apparently it was first noticed about 1904, but it was not recognised specifically until 1907, when it was discovered at East Liss in Hampshire. Since then it has been noted in many localities in England and Scotland, most probably having been distributed with nursery plants, but it has not, as far as is known at present, spread into Wales and Ireland.

The life cycle of *Ch. cooleyi* has only been partly elucidated in Great Britain, its habits from June onwards being unknown. It is well known, however, that it winters on the needles in the larval stage. These larvae are clearly visible to the naked eye, appearing as minute black specks on the wax of the under-side of the needle. In the majority of cases these larval forms are concentrated on the more shaded branches that is, the infection is most apparent near the stem. It is this form which produces the white wool so noticeable on the trees in early spring. When these larvae mature, they deposit numbers of brown coloured eggs on the old needles, beneath the protective coat of wool. About the middle of May the individuals hatched from these eggs, migrate along the branches to the newly formed shoots and settle there on the under sides of the needles. In June, two types of individuals appear from these migrants, namely, *a*) wingless forms which produce white wool and deposit their eggs on the same host plant, and *b*) winged forms. At this point the knowledge of the life-cycle fails. Probably the wingless forms maintain the infection on the original host, producing either larvae which rest until the following spring or a series of generations, each similar to the previous one, the last of which in autumn will give rise to the hibernating larvae on the needles. The winged forms leave the Douglas fir needles almost immediately, to seek new hosts of the same or another species.

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(1) See No. 965 of this *Review*. (*Ed.*)

It is not possible to say in the present state of knowledge, whether *Ch. cooleyi* will become a dangerous pest. It is incapable of ravages comparable with those of defoliators or bark pests and yet it must necessarily reduce the vigour of the host. No doubt, when attacks are recurrent, there is considerable loss in increment, particularly when young stock is in question.

The old needles, attacked by the early spring form, show some yellow discoloration on the upper surfaces. The succeeding generation which attacks the young shoots, causes mottling on the upper surface of the needles, a certain amount of deformation or " elbowing " and when the pest is numerous the whole shoot wilts under the attack.

It is not likely that the fir will be killed by *Ch. cooleyi* unless the trees are severely attacked for a number of consecutive years.

The prominence of the pest in 1921 is probably due to the climatic conditions of the winter and spring seasons, the mild winter favouring the hibernation of the larvae on the needles, and the warm, dry spring aiding and accelerating the maturation and multiplication of these individuals.

The inseet can be controlled readily in the nursery by the use of a nicotine soap wash, or even a strong soap wash alone if the remedy is applied in the autumn, when the insect is in the larval stage, unprotected by any woolly covering. In any case, nursery plants, infested, or even liable to infestation, should be cleaned in some such manner before despatched to another locality, because no economic measure for the eradication of the pest once established in the plantation can be advocated.

[971]

RUGGERI ALFREDO, *gerente responsabile*

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FIRST PART

ORIGINAL ARTICLES

A High School of Rural Household Economy in Belgium

by JEANNE DE VUYST

From the first, the instruction in Rural Household Economy which owes its origin to Director General PROOST has been deservedly successful with the inhabitants of the country districts of Belgium and is developing rapidly. For a long time past, however, the Inspectorate has indicated the need for giving a more scientific training to the teaching staff of the Intermediate Rural Education Services and of the Peripatetic Schools. Moreover, it appeared to be of the highest importance to have some form of Higher Professional Education for the daughters of the large land owners and farmers, and for women who intend to live in the colonies. At several important conferences it was urged that the scheme of Agricultural Instruction should include an "École Normale supérieure" During their travels the women Inspectors of Household Economy had come across instances of schools of this class in other countries and were of opinion that Belgium should not be allowed to lag behind its neighbours.

Hence the Council for the Improvement of Agricultural Education decided that it was necessary to establish one of these higher schools for girls. Thanks to Baron RUZETTE, Minister of Agriculture, a High School of Rural Household Economy was founded at Heysel (Laeken, Brussels) in October 1920, with the object of turning out specially trained women competent to direct field work or to act as leaders of groups of farmers' wives, familiar with modern methods, or as themselves the wives of landed proprietors in sympathy with country life.

The new Institution has also the equally important object of serving as a Training College for Mistresses able to popularise and disseminate Technical Instruction.

The Higher Training College "Institut Normal supérieur" of Rural Household Economy is situated at Heysel, near the Royal Palace of Laeken in the fine estate of Hosseghem, which is within 30 minutes journey of the Gare du Nord, at Brussels. The estate comprises 24 acres of cultivated land and a magnificent park, 36 acres in extent. For practical work, a farm, kitchen garden, orchards and ornamental grounds are provided as well as land intended for various crops.

The organisation of the domestic life is particularly interesting. Each student has her own room and all the rooms are differently arranged so that the students can become acquainted with the most suitable types of furniture. To save space some very interesting combination furniture has been designed. There is nothing of the forbidding aspect of a school about the place; as far as possible the students enjoy a family life.

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The school is directed by a Principal who possesses a Ph. D. degree, and is assisted by a staff of qualified Mistresses. Theoretical and Practical courses are given bv University trained professors. Each week, experts, either native or foreign, give lectures on questions of the day.

The methods of instruction adopted at the School are specially designed to develop initiative and common sense. Thus the students are expected to prepare their next lesson themselves, the subject only being given, and for this purpose they have access to reviews and books in the Library. Very little use is made of mere memory work.

Regular periods are devoted to practical work; every day a section is busy in the kitchen and another on the farm, and time is also set aside for work in the garden. This would appear to be the best method, for theory without practice is of little value and practical experience deepens the impression of the lesson. By these methods the Students learn to make the best use of their time and to organise their own work.

⁂

The Institute has been at work since October, 1920, and the examinations in July 1921, proved very satisfactory. The work and studies of the year are taken into account and rank equally with the examination results. The total of marks gained decided the rank and grade for entry into the second year; the marks obtained for the year's work count as one half and the examination marks as the other half. Memory plays quite a secondary part in the Examinations which lay for greater stress on what the students know how to do on their own account with skill and intelligence. Thus they have to prepare answers to a limited number of questions dealing with each of the courses taken, the questions being given to them at least three weeks before the examination. Each student has different questions to answer which are chosen by lot, and to help them to answer, they can have recourse to all the documents that have been collected during the year as well as to the books in the library.

Previous notice is also given of the practical tests which are also assigned to the students by lot. As evidence of initiative they are encouraged to submit new forms of apparatus not mentioned in the lectures and to demonstrate their value to an examining board. The highest marks are given to those who submit the most ingenious and practical devices which are most in accord with the general aim of the school and are designed to improve the amenities of rural homelife. The examinations are thus not of the ordinary character but are all the more a preparation for practical life.

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In a short time a new building, facing the present College, will be ready to receive the students, twenty in number, who have been admitted to the second year course Here too, each student will have her own room with its distinctive furniture. All the arrangements will be of the practical order but simple and in good taste and avoiding any scholastic severity. A baby clinic is also being erected and the students will thus be initiated into their future duties as wives and mothers. In all probability they will be given the care of young children orphaned by the war and be charged with their upbringing till they reach school-age. The Director's private house will also be in the grounds.

It should be noted moreover that the College can come to an agreement with similar institutions in other countries to arrange for the temporary interchange both of members of the staff and of students. This should prove of the utmost value to both as they will able to compare methods and return from their sojourn abroad with interesting experiences, which will be all to the advantage of the progress of the Higher Training College scheme.

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A large number of well-known persons both of Belgian and of other nationalities have visited the College and can testify to the fact that thsi new Institution is a busy hive of intensive and intelligent work. The students, both Flemish and Walloon, meet together in the lecture rooms and in the practical work; throughout the work proceeds cheerfully and with zest just as in home surroundings. They are allowed a wide measure of liberty and are not constantly annoyed by paltry and useless regulations; it is intended that they should themselves establish the good tone of the College and feel then own personal responsability for it. They are aware that the College can be a "higher" Institution in any true sense only if they themselves attain to the higher level both moral and intellectual. This elementary truth, on which every constitution should be founded. is well understood by the students, and it is a genuine pleasure to see how cheerily they work even at the humblest tasks.

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This quite summary description gives but a very incomplete idea of the importance of the Institution. The reader would be well advised to supplement his knowledge by applying to the Administration for a copy of the illustrated prospectus, and, best of all, he should himself pay a visit to the College where he will be sure of a warm welcome.

Motorculture in Spain

by

M. MIGUEL BENLLOCH

Agricultural Engineer

The special geological structure of the Spanish Peninsula and the very varied nature of its topography account for the existence of very diverse climatic and agrogeological conditions. It would therefore be very difficult to establish any specific characteristic for Spanish Agriculture ; its types are so complex that it would almost be correct to say that all systems are included. There is therefore no necessity to inquire whether motor-culture has its place in Spanish agriculture.

The factors which brought into being the problem of motorculture in other countries had their exact parallels in Spain and on the widest possible scale. In consequence of the European war the problem has been greatly intensified for the belligerent countries, and great developments have taken place but, unfortunately, rather in the domain of material than of economic solutions. There has been some repercussion of the crisis in Spain also, though naturally its characteristics have been far less serious, seeing that the principal cause, the labour shortage, is not felt there. It was, however, sufficiently strong to stimulate a remarkable amount of interest among Spanish agriculturist, which has continued to increase up to the present time and is evidenced by a growing demand for tractors.

As no machines were made in the country it was necessary to buy in the foreign market. It was inevitable that the North-American machines had a great advantage, principally because the United States were most favourably situated for providing this class of goods, and might almost be said to be the only Nation able to give delivery.

The use of tractors in Spain began after the outbreak of war. At first it met with considerable suspicion, and was regarded merely as the beginning of an attempt to solve the problem of motorculture (in its practical aspect) and as yet only a question for technical experts. The experts had, in fact, foreseen the need and were already considering the problem.

The results have been and continue to be collected and recorded carefully by Prof. MARIANO FERNANDEZ CORTES, Director of the Royal Station for Machine testing in Madrid, the leading Spanish authority on the subject. The antipathy of the farmers to the use of tractors (machines for motor-culture) and their reluctance to envisage the terms of the problem and to devise means for arriving at a possible solution is now declining; more rapidly in the South than elsewhere. In this region in consequence of the extensive methods of cultivation employed, the question was of a more urgent nature and the use of tractors appeared to become more and more appropriate as they became better known.

One is justified in stating that the former antipathy has now been converted into sympathy, and that while the decrease of the former was by no means uniform, the latter shows to a marked degree a general tendency to increase, which may even be regarded as somewhat dangerous. For it is impossible not to recognise that it is partly due to false notions encouraged by the exaggerated propaganda carried on by manufacturers and the equally delusive ideas inspired by the motor-culture competitions, at which the spectacle of the cutting a few furrows with relative ease merely conduced to an unintelligent and ill-considered use of the tractor, leading to disastrous results.

In spite of the increasing frequency with which tractors are now employed, there are probably not more than a thousand at work in Spain at the present time. The work which the technical experts have undertaken in order to obtain a solution, or rather solutions, of the problem, for in consequence of the extreme variety of the circumstances and conditions of each case a single solution is impossible, presents itself under a double aspect.

I. — The work carried out by the Royal Station in machine-testing in Madrid. This provides an accurate description of the characteristics of the different types of tractors in use.

II. — A comparative definition of the types of work and performance of the different grades of tractors as the result of open competitions in various districts.

The first provides a form of guarantee for the farmer who desires it, the second a standard of judgment in the choice of a suitable type or method. Moreover the " Granjas agricolas " (Experimental farms) of the State also conduct trials and practical demonstrations with their own machines. They display both advantages and difficulties, so that the farmer can draw his own conclusions for each particular case.

Below is a list of the types and models of the tractors which have been introduced into Spain up to the present (1921): for the sake of clearness, they are divided into groups.

INDEPENDENT TRACTORS, WITH LAND WHEELS.

With two driving wheels: United States: " Avery " 25 HP; " Hart Parr " 30 HP; " Deering " 20 and 30 HP; " Rumely Oil Pull " 20 and 30 HP models; " Titan " 20 HP; « International " 16 HP; " Case " 18, 27 and 40 HP models; "Emerson" 20 HP; "Fordson 22 HP; "Parret" 25 HP; "Nilsson" 36 HP: — French: "Citroën" 12 HP; "Chapron" 20 HP: — English: "Happy Farmer" 25 HP; "Saunderson" 25 HP; "Austin" 25 HP: — German: "Hansa Lloyd" 25 HP; "Lanz" 25 HP. — Italian: "Fiat" 25 HP; "Romeo" 25 HP.

With a single driving wheel "Benz" 25 HP (German); "Big Bell" 25 HP (United States).

INDEPENDENT TRACTORS, WITH CHAIN TRACKS.

United States: "Cletrac" 20 HP; "Holt" 35 HP; "Steel Mule", "Yuba" 25 HP: — French: "Renault" 30 HP; "César" 12 HP (single track): — German: "W. D." 35 HP.

TRACTORS WITH THREE DRIVING WHEELS.

"Glasgow" 27 HP (English)

MOTOR CULTIVATORS OR MOTOR PLOUGHS.

German: "Komnick"; "W. D." 80 HP: — Czechoslovakia: "Excelsior" 40 HP, "Praga" 40 HP: — United States: "Moline" 18 HP; "Doct all" 9 HP; "Beeman" 6 HP: — French: "Agro" 12 HP; "Tourand-Latil" 35 HP.

OTHER MOTOR DRIVEN MACHINES.

French: " S. O. M. U. A., 4 and 25 HP. models.

To sum up spain has already had experience of 23 machines of North American manufacture, 8 French, 6 German, 4 English, 2 Italian and 2 Czechoslovakian.

To give an idea of the method of the motorculture trials some details are appended of two important tractor-trials, which took place at Seville and Saragossa (1) respectively, towns typical of two quite distinct types of Spanish agriculture.

The following were the points of mechanical detail and working power which served as the the basis of classification at the Seville trials:

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(1) See *R.* Nov.-Dec. 1920, No. 1168. (*Ed*).

Mechanical features and conditions of the work carried out by the machines.

I — Indicated power of motor.
II — Maximum tractive effort at base (in kg.).
III — Nature of work carried out by the machine.
IV — Depth ploughed under the test conditions
  - Maximum.
  - Average.
  - Minimum
V — Working capacity under test conditions.
  - Length of trial.
  - Surface worked in trial.
  - Surface worked per hour.
  - Resulting classification.
VI — Type of fuel used.
VII — Fuel consumption.
  - Per hour.
  - Per hectare.
  - Resulting classification.
VIII — Description.
  - Of ploughing.
  - Of behaviour of the machine.
IX — Amount of soil displaced per hour.
X — Notes.

Technical coefficients for comparison carried out by the machines in uniform soil.

I — Nature of the resistance *R* of the soil worked by the machine determined by the model PARLIN plough and the SCHAFFER and BUDENBERG self registering dynamometer in kg. per sq decimetre of the furrow.
II — Section *S* worked (as executed by the machine in accordance with the terms of the test) in sq. decimetres.
III — Average working speed *V* in metres per second.
IV — Tractive effort *R. S. V.* compared with the model plough in kilogrammetres. in H. P.
V — Fuel consumption *C* per working hour in litres of gasoline.
VI — Consumption per effective H. P. compared with model plough coefficient of comparison $\frac{C}{P}$
VII — Notes.

At the Saragossa trials, the technical data were recorded similarly with such modifications as were required by the nature of the district

A special feature of this trial was the carrying out of a test or demonstration on ground with a slope not exceeding 1 in 12.5 feet. This trial is of special interest because of the hilly character of many districts in Spain, and the comparative results were of considerable importance.

It will be seen that detailed and careful observations were made on both the mechanical and the agricultural side of the tractors' work, so as to provide a comprehensive description, indicating in definite and concrete form the nature of each machine.

The abundance in certain areas of dry tracts of country with an irregular or very scanty rainfall and great summer heat, and the compact nature of certain soils put a greater draught strain on the tractors that than for which they are naturally built. The result is a sensible reduction in the work that can be expected of them which is naturally disadvantageous economically. This is the explanation of the not infrequent phenomenon that a tractor reputed to be able to draw with ease a plough with three shares, finds it very difficult to draw one with two shares only on Spanish soil.

Difficulties regarding mouldboards and inadequacy of turning space, as well as the small size of the holdings in certain districts are additional and serious obstacles to the development of motor-culture in Spain.

Hence there still remain a number of practical problems and it is to be regretted that the national trade interests still lack the energy to make a contribution to their solution. With their intimate knowledge of the special nature of the agriculture of the country, they are advantageously placed for the invention of a limited number of classes of tractor, which could fulfil the conditions of an ideal machine. Among these must be reckoned: Strength combined with lightness, i. e., the minimum of weight; small dimensions; high penetrating capacity; small consumption; solidity combined with ease in working, allowing for the fullest attention to be given to the plough and the work: equal ease of working both on the outward and the return journey.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

972 - **The Danger of Using Hydrocyanic Acid for Disinfecting Flour.** — MARCHADIER (Directeur), GOUJON (Chimiste du Laboratoire Municipal du Mans), and DE LAROCHE (Directeur du Laboratoire d'epidémiologie de la 4e région), in the *Journal de Pharmacie et de Chimie*, Year 113, Series 7, Vol. XXIII, No 10, pp. 417-420. Paris, May 16, 1921.

The authors advise that the treatment of flours with hydrocyanic acid should be prohibited, for investigations made in the Mans municipal Laboratory have shown that flour can fix an appreciable amount of this acid. The sample examined, which was of pure wheat flour, contained, 82 mg. of prussic acid per kilogram. This is below the danger limit (118 mg.) fixed by the Higher Council of Public Health of France (*Conseil supérieur d'hygiène de France*).

It must, however, be remembered that flour in the form of bread is the basis of man's daily food, and that baking does not remove all the prussic acid it contains; hence the presence in flour and other foods of even smaller quantities than the amount permitted by the above Council, constitutes a danger to the consumer.

973 - **The Meat of Tuberculous Cattle from the Hygienic Standpoint.** — SPARAPONI, G. C. (Assistant Inspector of the communal Abattoir of Venice), in the *Annali d'Igiene*, Vol. XXXI, No 2, pp 125-131. Bibliography of 44 works. Rome, February 1921.

The problem of the use of meat from tuberculous cattle in the ordinary way for human food has been much discussed and studied during the last fifty years, but the results obtained have been contradictory and differently interpreted. This is due to the fact that, owing to the lack of accurate methods for determining the presence of latent tubercule bacilli in the meat or organs of tuberculous cattle, there, are no data upon which a correct judgment can be based. The author points out that the different results obtained by modern investigators as well as those of former times are attributable to the different anatomical type studied by them.

At the present day, the anatomical forms of tuberculosis which make the meat toxic are well-known, but such meat when cooked, becomes innocuous, and according to NOCARD and and LECLAINCHE, "the consumption of meat which is even raw, or but little cooked, and contains some tubercle bacilli has certainly no bad effect upon man." Further, there is no fear of toxic tubercular substances remaining in the cooked meat, since, as GALTIER and EDELMANN have shown, tuberculous beef contains only negligible quantities of such matters and these are very rapidly eliminated by the organisms of living cattle; this has been demonstrated by FIORENTINI and GARINO, who thus explain the fact that even serious tubercular lesions may exist where the state of nutrition of the affected animals is excellent.

RUMPEL, and many other authors, have shown that the nutritive value of sterilised meat of tuberculous cattle is in no wise inferior to that of the flesh of healthy animals, so that the meat may safely be used for human food, for which purpose it is now very frequently sold in secret. The author therefore advises a radical change in the regulations of the present Italian health legislation dealing with the use of the meat of tuberculous cattle (art. III of the General Health Regulations, February 3, 1901).

974 - **Experiments made in the United States Concerning the Practical Application of X-ray Radiation in the Destruction of *Trichinella spiralis* in Infested Meat.** — SCHWARTZ, B., in *Journal of Agricultural Research*, Vol. XX, No. 11, pp. 845-854. Washington, March, 1921.

Six series of experiments conducted by the Zoological Division of the Bureau of Animal Industry, United States Department of Agriculture. The trichinous meat used in these tests was obtained from hogs (Series I, II, III and V) and guinea pigs (series IV). The first were killed several months after artificial infection, the second about one month after. The trichinous meat was packed in wooden or cardboard boxes and exposed to X-rays and then fed at once to rats and mice.

The units of X-ray varied in the different experiments. For series I, II and III respectively they were: 2899, 966, 191, 81, 35 and 19; 600, 300, and 350; 674, 924, 1363, 2162, 1081 and 3094 (1).

In Series IV, the infested meat was exposed to the direct action of the rays at a distance of about 25 cm. from the focal spot of a COOLIDGE-type tube. The pressure across the tube terminals was 73 kilovolts. The meat was exposed to radiation for 42, 84, 126 and 168 minutes respectively. The current through the tube varied during the time of treatment from 4.2 milliamperes to 4.9. The boxes were so placed that the rays from other tubes in the machine had very little influence on the contents.

In series V, the dosages used were not indicated.

Results of the experiments showed that the trichinae may be seriously injured by X-ray radiation. In series I, larvae isolated from the infested meat by artificial digestion 3 days after treatment, appeared to be unaffected. These larvae were normal in colour and in reaction to heat, whilst larvae from treated meat fed to rats and mice were incapable of attaining full sexual maturity in the intestines of their hosts. Injuries from X-ray treatment are not visible in the encysted or artificially decapsuled larvae by artificial digestion (gastric juice), but becomes apparent only when the larvae find a suitable host in whose intestine they are normally capable of continuing their development.

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(1) Purely arbitrary units 1000 of which are equivalent to a dosage received at a distance of 5 in. from the focal spot of a COOLIDGE tube with a current of 4.2 milliamperes and a pressure of 70 kilovolts across the tube terminals. Treatment continued for 42 minutes.

In certain cases, trichinae underwent granular degeneration. In others, sexual maturity was attained, but no evidence of successful copulation could be found, which indicated that the structural and functional sex maturity was non-existent and the sex cells appeared to be atrophied.

In addition, trichinae appeared to exhibit considerable variation in their susceptibility to X-rays. Certain intensities gave rise to injury in some cases and had no effect in others which may be accounted for by factors as yet not determined.

Admitting that a reliable method of destroying the vitality of the sex cells in trichinae by means of X-ray treatment of infested meat can be perfected, it is still questionable whether such a method would be acceptable as a prophylactic measure. The trichinae apart from the damage done by their migrating larvae are offensive as intestinal parasites. Consequently, unless the X-ray treatment has the effect of diminishing the injurious action of the intestinal stage of trichinae upon the host as well as destroying their powers of reproduction, it can scarcely be considered a satisfactory prophylactic measure.

The author quotes the observations made by TYZZER and HONEIY (1) who found that encysted trichinae, subjected to radium radiation, failed to develop in mice. These investigators also determined that whereas radium radiation failed to destroy sexually mature trichinae in live rats, trichinae in rats which were exposed to the rays beginning with the second day after ingestion of trichinous meat, showed retardation in development. Radiation of the larvae in rats before they had begun to develop proved fatal to them.

The experiments described do not permit the drawing of any definite conclusions as to the feasibility of using X-ray radiation as a practical means of destroying trichinae in pork.

975 - **The Transmission of Poison from *Rhus* spp. to Persons.** — MC. NAIR, J B, in *American Journal of Botany*, Vol VIII, No 5, pp 238-250, bibliogr. of 49 works. Lancaster, Pa, May 1921.

Report of investigations made by the author in connection with the transmission of *Rhus diversiloba* poison from 3 standpoints: botanical, chemical and pathological.

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(1) TYZZER, E. E., and HONEIY, H. A., The effects of radiation on the development of *Trichinella spiralis* with respect to its application to the treatment of other parasitic diseases *Journal of Parasitology*, Vol. III, No. 2, pp 13-56, 1916 (*Author's Note*)

From the results obtained it may be concluded that the poison is non-volatile as it is not distillable normally by steam or under reduced pressure, and cannot be carried by contact with a volatile substance. This is contrary to the idea put forward that it is a non-volatile poison carried by a volatile oil.

Dermatitis occurs only on the area of skin to which the poisonous sap has been applied; a general irritation is not produced as by volatile irritants. It does not diffuse rapidly in the skin ; the period of latency is very long. Portions of the plant which do not cause dermatitis are: the pollen, trichomes, epidermis, cork cells and xylem; the poison is confined exclusively to the resinous sap. Leaves decrease in virulency by drying, owing to loss of fluid of the sap and from oxidation of the poison. Poisoning without actual contact with substances that have poisonous sap on them, such as clothing or hair of animals etc. may occur.

The author gives details of work carried out in connection with *Rhus* poisoning for very many years by various investigators but makes special mention of the work done by PFAFF on the active principle of *R. toxicodendron.* (*Journal Exp. Med.*, vol 2, pp. 181-196. 1897) who was the first to come to the conclusion that the poison must be a non-volatile skin irritant.

976 – **Ligurian Provincial Committee for Small Industries.** — *Bollettino dell'Associazione Italiana Pro Piante Medicinali, Aromatiche ed altre utili*, Vol IV, No 7, pp 110-111. Milan, July 1921

A provincial committee for small industries has just been established at Porto Maurizio. Its programme includes the following subjects:— Practical instruction in herb-growing; instruction in distillation; instruction in trading in aromatic and medicinal plants; instruction in the formation of co-operative societies of herb-collectors and distillers; lessons in cultivating the above mentioned plants; assisting and advising persons interested in this work. The institution is subsidised by the Ministry of Agriculture, and is going to lay out at least 2 experiment fields.

CROPS AND CULTIVATION

977 – **Weather Forecast and Agriculture.** — GOLD, E., in *The Scottish Journal of Agriculture*, Vol IV, No. 3, pp 251-258, 1 fig Edinburgh, July 1921

Forecasts are now made in Great Britain in the following way:— Reports are collected several times a day from different places scattered over a wide area extending from Ireland to Madeira and from Spitzbergen to Cairo ; a few reports are also received, almost daily, from some ship in the Atlantic to the West of Ireland.

The data transmitted give information respecting:— The height of the barometer; the way in which the barometer has been changing; the temperature ; the direction and speed of the wind; the clearness and humidity of the air; clouds and their height; and a brief description of the weather at the time, and in the interval since the preceding report.

By an ingenious utilisation of figures, the whole information is telegraphed in 4 groups, each consisting of 5 figures.

The information thus received is entered upon charts or maps. These maps are compared with the maps immediately preceding them and with maps for the same season in previous years, to see what changes followed when the maps had the same characteristic features as those from which the forecasts are being prepared. Data showing the temperature and the direction of winds at great heights are also obtained, one from aeroplanes, the other by the observation of small free balloons.

In forecasting the following principles are always kept in mind:—

(*a*) Weather travels, so that a region will usually experience the weather which is travelling towards it.

(*b*) Hills and mountains modify the weather by forcing the masses of air to rise to greater heights, where they may condense.

(*c*) Cold surface air tends to displace the layers of warm air beneath it, thus also producing condensation.

(*d*) Cold air moving over land or sea, where it becomes unduly warmed at the surface is set into vertical circulation, with the production of cloud and showers.

In 9 cases out of 10, it is possible to forecast with reasonable accuracy and confidence for a period 24 hours ahead.

In addition to the information supplied to the Press, special telegrams are sent to any address on payment of the cost of the telegrah and a small registration fee.

In this way regular forecasts are provided, notifications of spells of fair weather are issued, and telegrams are sent indicating the progress of meteorological events, and warning when the spell is about to break. Frosts and storms are also notified.

The author makes some remarks on the organisation of the Meteorological service abroad, especially in the United States where excellent results have been obtained, and expresses the hope that Great Britain will follow the good example set in America. He strongly advises the use of signals hoisted in some prominent position to announce the approach of frosts or of severe gales, or the setting in of fair weather.

978 - **Summer Rainfall and the Penetration of Mediterranean Vegetation into the French Pyrenees.** — GAUSSEN, H., in the *Annales de Géographie*, Year XXX, No. 166, pp. 249-256 + 1 Map. Paris, July, 1921.

The character of the basins of the Ariège and the Hers is, from the physiographical standpoint, distinctly Atlantic, for the mountain chains are so arranged as to create, in the central part of the Pyrenees, conditions favourable to the penetration of oceanic influences.

Nevertheless, in some of the regions situated on the further side of the limestone mountains of Ariège and Garonne, distinct oases of Mediterranean vegetation are to be found. This vegetation is characterised by its power of enduring prolonged drought. The author studies the special conditions of these oases from the points of view of the climate and the flora, taking as his basis 3 factors:— The drought map; (2) the limit of the olive-tree; (3) the limit of the ilex.

Drought Map. — For the eastern sector, the months of June, July, August, and September were examined, and for the western sector, July, August, September and October. The total rainfall during the four months provided the data for making the curves, and the map upon which they are drawn, this period being the driest of the year in the regions under consideration.

An examination of the map reveals a very interesting fact, *viz.*, that in the midst of the rainy mountainous district, relatively dry oases are to be found situated at the bottom of the valleys. Thus, at Tarascon, in the valley of the Ariège, the rainfall for the four months is 226 mm., whereas in the immediate neighbourhood at Prat Communal, Cabannes, and Foix, it is 439, 265 and 255 mm. respectively. In the same way, the rainfall at Suz, a dry spot, is 257 mm., whereas 306 mm. of rain fall at Gavarnie, 336 mm. at Argelès, and 359 mm. at Lourdes during the same period.

Throughout all these regions, the rainfall seems to decrease as the valleys are ascended. This is probably due to the condensing action of the great buttresses covered with forest that intercept the last water-vapour coming from the Atlantic, thus at once creating a dry zone in the upper parts of the valleys.

Limits of the Olive Tree. — The olive grows along all the valleys of the middle Pyrenees, penetrating far into the mountainous district to the average height of 875 m. at Olette in the Tet valley.

An examination of the maps showing the dry districts, and the distribution of the olive will reveal many points of resemblance between the two. Thus, the 180 mm. curve marks the limit of the maximum cultivation of this tree, and the 200 mm. curve coincides with the extreme limit of its growth.

Similarly, the patches of olive trees in the high valleys are often found on dry spots. These facts are the more remarkable, seeing that drought is a somewhat complicated factor depending, not only upon the amount of the rainfall, but equally upon the duration and intensity of the atmospheric precipitations, temperature, evaporation, agrogeological and topographical conditions, etc.

Limits of the Ilex. — As with the olive, the pluviometric curves of summer drought give interesting results for the ilex. The tree is found only in the immediate vicinity of Tarascon (being entirely absent in the surrounding district) and, as we have said above, at Tarascon, in the valley of the Ariège, there are only 226 mm. of rain in the 4 wet months, although the rainfall in the neighbourhood is higher.

From the examination of the large amount of data collected, the author has concluded that, in the eastern sector of the Pyrenees, the ilex when growing on calcareous soils, cannot stand more than 200 mm. of rain in summer, whereas in the south-eastern and south-western sectors where the ground slopes considerably, it is not harmed by as much as 250 mm.

Excessively low temperatures in winter may quite exclude all southern trees, but there are many places in the Pyrenees where they do not grow in spite of the relatively mild winters. On the other hand, the capacity of resisting low temperatures often depends upon the meteorological conditions of the preceding summer, which must be dry, to enable the tissues to mature properly.

The dominant factor determining the existence of Mediterranean oases in the French Pyrenees is, without any doubt, the dryness of the summer, as is clearly seen in comparing the rainfall charts (for the 4 dry months) and the maps of vegetation.

979 - **Weather Bureau Activities in California as Applied to the Production of Sugar Beets, Citrus Fruits, Dates and Rice.** — PALMER, H. A., in *Monthly Weather Review*, Vol. 49, No. 4, pp 219-223. Washington, April 1921.

While most climatological data obtained in California are used directly or indirectly in agriculture, certain stations are maintained primarily for this purpose with reference to the more important crops.

1) SUGAR BEET. — The Spreckels Sugar Co. has established a scientific laboratory at its headquarters which includes in its equipment all the standard meteorological instruments, and amongst them the various types of air and soil thermometers found at a first-class Weather Bureau Station. Investigations have shown that there is an intimate and complex relationship between weather and the sugar content, but the optimum weather condition has never been determined as it varies with soil, elevation, latitude and time of sowing. It has already been recognised that the optimum weather for the production of seed does not correspond with that for sugar production. As a result, however, of these conclusions, the experiment station has established a considerable number of climatological stations near the Coast of Central California and in the interior valleys. Another company, the Union Sugar Co. with headquarters at Bettervia, also maintains a meteorological service of its own but on a less extensive scale.

2) CITRUS FRUITS. — Climate determines the districts available for the successful culture of citrus fruits. The bulk of the crop is grown in southern California, and the foothills of the interior valleys of central and northern California have been found well adapted to its cultivation. The most northerly orange groves, near Oroville, produce the first mature oranges every autumn for which fancy prices are paid.

It is unnecessary to add that meteorological data form an important consideration in the successful production of citrus fruits. These relate principally to frost, heating, hot waves, fumigation, irrigation, etc., which necessitates a complete knowledge of local atmospheric conditions. Official weather data is available at the orchard meteorological Stations the chief being: Pomona, Redlands, Riverside, Porterville, Lemon Cove, Lindsay, Oroville and Yorba Linda.

3) DATE PALMS. — Successful date culture on a commercial scale requires tropical or semi-tropical weather conditions. Frosts or prolonged low temperatures cannot be endured by the date palm and the mean temperature must be relatively high. On the other hand, the water requirements are light, and the palms will flourish in what appears to be a sandy desert, provided that the temperature conditions are favourable. These peculiar conditions are found in the Coachella Valley where the United States Bureau of Plant Industry has introduced the culture of the date palm on an extensive scale. About 70 species, imported from Africa or Asia are under inspection at the India Experiment Station. Seedlings of the best adapted varieties are already available for distribution. Special mention is made of the "Delget Noor" variety which has been found to be adapted to general cultivation in the Imperial Valley. Meteorology has contributed in no small measure to the successful introduction of the date palm; meteorological instruments form an important part of the equipment of the India Experiment Station and of the Mecca substation.

4) RICE. — Less than 10 years ago, the Department of Agriculture introduced rice culture into California on a commercial scale on the flood plain of the Sacramento River. The new industry grew rapidly; the limiting factor seems to be inadequate water supply, hence the importance of controlling the factors in order to permit the highest possible use and at the same time economy of water. Of particular importance are precipitation and river-stage data in connection with irrigation. The University of California also maintains an independent evaporation Station in connection with its Rice Experiment Station, and yet another at Dodgeland in the heart of the rice growing district, maintained by the Weather Bureau and by the Dodgeland Co.

In conclusion it may be added that there is no agricultural undertaking of any kind in which meteorological problems do not stand in the forefront.

980 - **Acid Soil Studies in the United States.** — I ROBINSON, R. H., (Oregon Agricultural Experiment Station), Acid Soil Studies — I. A Study of the Basic Exchange Between Soil Separates and Salt Solutions, in *Soil Science*, Vol XI, No 5, pp 353-361, tables 8, bibliography of 6 works. Baltimore, M D, May, 1921. II. ROBINSON, R. H., and BULLIS D. E, Acid Soil Studies: Changes in Calcium Compounds Added to Acid Soils. *Ibid.* pp. 363-367, tables 4, bibliography of 5 works.

I. — Four characteristic acid soils were selected for study in Western Oregon (silt loam, gravelly loam, clay loam, medium sandy loam) and soil separates were made by mechanical analysis of the different samples. Five different salts, namely potassium nitrate, potassium chloride, potassium acetate, calcium acetate and sodium chloride were used in the study.

From the results obtained it may be concluded that the acidity of the different soil separates liberated by the action of a certain salt solution is approximately the same, although the manner in which the salts of mineral acids react with the soils studied is apparently different from the reaction with the salts of an organic acid. The so-called acidity liberated by potassium nitrate, potassium chloride and sodium chloride is due mainly to aluminium and iron rendered soluble by basis exchange. However, the acidity produced by calcium acetate and potassium acetate was due to acetic acid liberated either by replacement of the hydrogen of hydrous silicates or by selective adsorption of the basic element in the salt solution. The hydrogen-ion concentration of the different separates of the soil was constant.

Results indicate that the size of the soil particles, the presence of colloids or organic matter in the clay separates or the composition of the different separates does not have a great influence on the hydrogen-ion concentration, and consequently on their acidity.

II. — In the foregoing investigations, studies were made to ascertain the reasons why some acid soils of Oregon do not respond to lime treatment. In an effort to answer this question further experiments were carried out with the same soils by the application of calcium carbonate and calcium oxide used in amounts equivalent to the lime requirement of the different soils. The pots containing the soil thus treated were sunk into the ground and spring barley was grown in them to aid natural functioning and changes that the calcium compounds might undergo. After exposure to the weather for one year, representative samples were taken and the calcium determinations were made.

It was demonstrated that, when calcium carbonate or calcium oxide was added to several acid soils, most of the calcium was retained after exposure to weather for one year, although part had been lost by leaching by about 40 in. of rainfall; the calcium retained was combined chiefly with humus and easily decomposable silicate. Most of the calcium present in the acid soil that did not respond to lime treatment (the gravelly loam) was found combined as a silicate decomposable with difficulty. This, however, does not explain the reason why the soil does not respond to lime treatment.

In any case, after exposure to the weather for 1 year, all the soils treated as mentioned above gave an alkaline reaction.

981 - **Studies on the Rate of Formation of Soluble Substances in Several Organic Soils in the United States.** — McCool, M. M., and Wheeting, L. C. (Michigan Agricultural College), in *Soil Science*, vol. XI, No. 3, pp. 233-247, figs. 5, tables 7, bibliography of 2 works. Baltimore, M D., March, 1921.

Research concerning the rate of formation of soluble salts in a great many mineral soils have been made, but little is known of the behaviour of organic soils under similar conditions.

The results of a preliminary study of such activities in 7 organic soils are here presented concerning: —

1) The relative solubility (taken to mean the power of soil to form soluble substances) under different moisture conditions.

2) Relative solubility of different depths of the soil section under optimum moisture conditions, the freezing point method for the determination of soluble material in the soil solution being employed.

According to the results obtained, at any given moisture content, the effect of a higher temperature is to increase the rate of formation of soluble material, and conversely, lower temperatures decrease the rate of formation. For the higher temperatures, optimum moisture conditions tend to bring greater amounts of material into solution than are found under saturated water conditions; exactly the opposite effect was observed with lower temperatures. Generally moist soils upon standing, increase in concentration to a certain point, after which a decline occurs. This is probably due to the following causes: *a*) reabsorption, *b*) chemical change to less soluble compounds; *c*) biological activity. Organic soils vary at different depths in the amount of soluble substances present; different depths also vary in the rate and amount of material made soluble upon standing. Below a depth of 2 ft. the muck soils studied are very inactive; the surface layers usually produce the bulk of the soluble plant foods, and in general the ability to yield soluble materials decreases regularly from the surface to the water-table

The comparison made between the depth of weathering of organic and mineral soils is of decided interest, and investigations show that the climatic action is negligible below a depth of 2 ft. whilst the most recent mineral soils of fairly heavy texture have weathered from 3 to 6 ft. deep, and sandy soils even deeper. Apparently, therefore, there would be a larger area where the soil materials are more soluble in mineral soils, and this may have some bearing on the excessive fertiliser requirements for mineral elements in soils rich in organic material.

982 - **The Amount of Unfree Water in Soils at Different Moisture Contents.** — BOUYOUCOS, G., (Michigan Agricultural Experiment Station) in *Soil Science*, Vol. XI, No. 4, pp. 255-259, bibliography of 3 works. Baltimore, M.D. April, 1921.

A new classification of soil humidity has been demonstrated by the author: gravitational water, free water and unfree water (capillary adsorbed and combined) (1). By carrying out a series of determinations with reference to unfree water on diverse soils and with varying moisture contents, not including the hygroscopic moisture, it was evident that the amount of water which the soils are able to render unfree appears to remain constant, and does not vary with the different degrees of humidity. The dilatometer method was employed following the usual procedure, considering all the water that refused to freeze for the first time at the supercooling of —1.5° C. as unfree water, and that which did not freeze after supercooling at —4° C as combined water; and the difference obtained as capillary-adsorbed water.

The fact that the amount of water which the soils are able to render unfree does not vary with the degree of humidity, is extremely important especially in relation to the availability of moisture in soils at different moisture contents, the possible behaviour of soils towards fertilisers, the physical condition of the soil, etc. Changes in the physical condition of the soil causes a certain variation in the total amount of unfree water, and the form most susceptible is the capillary-adsorbed water whilst the combined form seems to remain constant; practically speaking, the transition from one form into the other is not absolutely sharp.

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(1) See *R.* June 1921, No. 507. (*Ed.*)

This constancy has been contradicted by KERN (1) according to the conclusions drawn from his mathematical considerations; this may be explained by the existence of unknown factors which make it unsafe to predict conclusions mathematically.

983 - **Analysis of Soils.** — VESTERBERG, K. A., Svensk Kem. Tidskr. 1921, 33, 12-22; in *Journal of the Society of Chemical Industry*, Vol. XL, No. 11, p. 401-A. London, June 15, 1921.

The author questions statements to the effect that salts dissolved in the moisture in soils are absorbed by plants at the same ratio as the water itself; the roots do not take up the salts etc. in the proportion in which they occur in the soil.

As regards the concentration of plant foods in soil moisture, which constitutes the minimum requirement of plants, the following quantities are suggested:

Phosphorous pentoxide, 1-2 mgm. per litre; nitrogen 2-5 mgm. per litre; potassium, 10-20 mgm. per litre.

Climate would possibly have some effect on the efficiency of these amounts of foods.

984 — **Irrigation with the Couten Sprayer.** — See No. 1041 of this *Review*.

985 - **The Influence of Fertilisers Upon the Productivity of the Soil.** — JORDAN, W. H., Soil Studies, I. The Influence of Fertilisers Upon the Productiveness of Several Types of soil. — II. The Influence of Fertilisers and Plant Growth Upon Soil Solubles in *New York Agricultural Experiment Station, Bulletin* 473, 27 pp. Geneva, N. G., March 1920.

It was found, by growing barley under forcing-house conditions, on 9 different types of soil consisting for the greater part of loams, the vegetative growth was influenced very little by the application of either litter or leaf-mould. During the first year's experiments, well-composted farm manure did not produced additional growth, although the results obtained with it the second year were satisfactory, but the plants to which commercial fertilisers were applied grew much more than those receiving stable manure, the quantites of nitrogen, phosphoric acid and potash being the same in the two cases. Slaked lime applied with farm manure had a very irregular effect according to the different types of soil, in short, nitrogen appeared to be the sole fertilising substance having a marked influence upon barley.

To confirm these results, two soils were selected, one highly productive, and the other less fertile, and barley again planted. It was found that, under forcing-house conditions, the soils appeared to supply sufficient quantities of phosphorus and potassium for luxuriant vegetation.

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(1) See *R.* 1920, No. 388. (*Ed.*)

The application to the soil of soluble compounds of nitrogen, phosphorus and potassium, materially increased the proportion of water solubles in the soil; these were used by the plants, and their amount was thus rapidly reduced before the barley had attained considerable growth. In the latter stages of its development, the quantity of the water-solubles remained constant and was much the same (with the exception of the phosphorus) as that present in the soil receiving no fertiliser.

To sum up; it would seem that from the practical standpoint, the above data show the importance of the solubility of the three essential ingredients of fertilisers, especially in the production of quickly-growing crops. Plants accumulate a large proportion of the required nitrogen and ash ingredients during the early stages of growth, for which reason, in the case of forcing-house culture, vegetable-gardening, and of such crops as cabbages, potatoes and wheat, an adequate supply of immediately available food appears to be indispensable in order to obtain good results.

986 - **Tertiary Nodular Phosphates in Italy.** — CORTESE, E., in *La miniera italiana*, Year V, No. 2, pp 49-51, 1 fig. Rome, February 28, 1921.

The author, after mentioning the nodular phosphates that have been found near Cape Santa Maria di Leuca, which he does not think worth consideration at present, owing to their low content of tricalcium phosphate (less than 30 %), passes on to describe the phosphates discovered in the Province of Syracuse (Sicily). The richest district appears to be that of Donna Lucata, where there are 2 phosphate beds of considerable thickness, and with nodules containing an average of 15 % phosphoric acid, corresponding to 30 %, or a little more, of tricalcium phosphate. A concession of some 500 hectares has been obtained in this district, from which about 1 ½ tons of nodules per square metre could be obtained; this would give a reserve of about 7 million tons.

This nodular phosphate is very rich in calcium carbonate (containing from 48.42 to 62.67 %), and barely contains half the tricalcium phosphate required for transforming it into superphosphate.

The phosphatic content of the nodules could probably be increased by means of a system which is at present on trial, or the nodules could be ground very fine, mixed with liquid manure, and used directly, like the low-grade phosphates and phosphatic marls of Belgium.

The author is of opinion, that these stores of phosphate should not be neglected, but that the example of other, even richer, countries, ought to be followed, and the poorest natural resources turned to good account, all the more seeing that as soon as the mines of Donna Lucata are opened (they are easy to work being on the surface, and situated on the seashore), a further extension of the deposit will be revealed, and it will be possible to investigate another phosphatic substance found outside the nodular layers, and called " giurgiulenaro " (1) from its granular structure. A sample which was analysed contained 18.54 % phosphoric acid (equivalent to 40.38 % tricalcium phosphate). Afterwards, a search could also be made at Cape Santa Maria di Leuca, with a view to discovering the phosphates that are certainly present in Tripolitania.

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(1) This word is derived from *giurgiulena*, which in the Sicilian dialect means a " nougat " of almond paste, honey and sugar; it corresponds to the Italian *giugiolena* = sesame. (*Ed.*)

987 - **An Esthonian Phosphorite and Its Effect Upon Different Plants.** — WRANGELL, M., in *Die Landwirtschaftlichen Versuchs Stationen*, Vol. 96, Nos 1 and 2, pp. 1-44, 3 plates, photographs, numerous tables. Berlin, 1920.

The scarcity of fertilisers during the war, led the author to experiment with various potassic and phosphatic minerals that had previously been neglected. Her investigations were begun at the Reval Agricultural Station, and were continued at the Hohenheim Station in 1918.

According to DEHN, the soil of Esthonia contains an average of 0.28 % of phosphoric acid soluble in 10 % hydrochloric acid, but some soils with fossil brachiopods, contain up to 1.5, and even 2.5 %. This is due to the outcrop of grey, blue (or even reddish and violet) upper Cambrian stones containing *Obolus Apollinis*, and passing down into the fucoid sand-sandstones. The beds are from 5 to 20 m. thick, whereas the true phosphatic shell-bearing conglomerate is only from a few centimetres to 1 metre thick. In the former, as in some of the neighbouring Ordovician strata, nodules of phosphorite with about 11 % of phosphoric acid are often found.

The author gives the detailed chemical composition of the different beds. The phosphoric acid content of crude *Obolus* sandstone of Reval, used in plant-growing experiments at Hohenheim was 20.4 % and the residuum (which is mostly shell-bearing), when freed from the excess of mineral matter, a process very easily carried out, may contain as much as 30 % phosphoric acid soluble both in 1 % hydrochloric and 2 % citric acid.

The *Obolus*-bearing conglomerate is composed of carbonate of lime and of apatite (like the Lahn phosphorite, Staffelite, and Dohllite), which easily dissolves in dilute organic acids, and hence is assimilated without difficulty by plants. As crystalline apatites which cannot be attacked by the roots of plants are usually also free from carbonate, the author is of opinion that this carbon content constitutes a character distinguishing earthy phosphorites, that can be disintegrated, from crystalline apatite.

The plant-growing experiments were made at Hohenheim, in zinc pots, provided with air pipes, and filled with clayey-sand poor in lime. All the pots, except the control series, were given potassic, nitrogenous, or calcareous fertilisers, the special fertilisers consisting of basic slag, two qualities of ground Obolus-sandstone (in different amounts), and other mineral phosphates.

The 1st *series of experiments* was made with mustard sown on Sept. 19 and gathered while in flower, on Nov. 2. A general nitro-potassic fertiliser was applied. The 2nd *series* with spring rye and clover, sown May 9, cut July 30, 1918, with the same general fertiliser as above; special fertilisers; apatite and Lahn phosphorite for the rye, and Staffelite for the clover. The 3^{rd} *series* with buckwheat, flax, colza, and vetches mixed with oats: sown end of July, cut in the autumn: general fertiliser Hallens mixture, plus gypsum and ammonium sulphate; special fertiliser 1.2 gm. Obolus-sandstone or basic slag. The results are given in the Table.

The remarkable effect of the Obolus-sandstone upon the mustard led to the conclusion that this hardy plant, which is very common throughout Esthonia very probably owes its favoured position to its power of breaking up and assimilating the phosphoric acid of the Obolus-sandstone; in this it is much superior to the Gramineae which make little use of the insoluble phosphoric acid present in the soil.

Obolus-sandstone gave but poor results with winter rye plus a supplementary nitrogenous fertiliser. If the special fertiliser, however, contained ammonium sulphate (a physiologically acid substance) in place of nitrate, better results were obtained; a like effect was produced by using large amounts of crude phosphates, as MITSCHERLICH did with success.

Average Crop in Grammes of Air-Dried Material.

Special fertiliser per pot expressed in grammes of phosphoric acid	Mustard	Spring rye	Clover	Buck-wheat	Flax	Colza	Vetches and oats
None	2.7	4.4	9.0	13.8	15.6	1.7–3.2	11.5
without phosphoric acid	8.1	4.3	10.5	36.4	12.3	8.2–4.5	16.4
Basic slag . . 0.4 gm.	31.3	—	—	—	—	—	—
» . 0.6 »	—	12.3	16.4	—	—	—	—
» . . 1.0 »	38.0	—	—	—	—	—	—
» . 1.2 »	—	18.0	17.9	70.6	27.5	10.5–7.9	31.1
» . . 2.0 »	38.9	—	—	—	—	—	—
Obolus sandstone 0.4 g.	26.3–27	—	—	—	—	—	—
» 5.6 »	—	6.1	12.8	—	—	—	—
1.0	35.2–35.6	—	—	—	—	—	—
» 1.2	—	7.2	15.8	73.3	18.9	10.1–7.7	28.0
2.0	36.2–38.9	—	—	—	—	—	—
Phosphorite, or Staffelite . . 0.6 »	—	7.0	12.6	—	—	—	—
» 1.2 »	—	6.5	13.2	—	—	—	—
Apatite . . . 0.6 »	—	3.5	9.5	—	—	—	—
» . . . . 1.2 »	—	4.3	10.5	—	—	—	—

The results obtained were more satisfactory with clover than with rye. No doubt, however, if the vegetative period had been longer, better use would have been made of the Obolus-sandstone and the Staffelite. In any case, although clover appears able to use the phosphoric acid of crude phosphorites, it can make no use of apatite.

When gathered (Oct. 13), the fruits of the buckwheat were partly ripe. Flax is not very susceptible to a phosphatic fertiliser and it is believed that this plant is more affected by the acid reaction of the soil than by the alkaline reaction or by lime (1). The results obtained from colza were of little importance, as the plants developed a disease of the roots. It is stated however, that from the beginning, colza is able to make good use of the phosphoric acid in both the sandstone and slag, w hereas the Graminaceae showed no signs of its effect until latter. The mixed vetches and oats used little more of the phosphoric acid of the sandstone than of the slag, but the vetches growing in pots with sandstone, suceeded better than those with slag.

Another series of experiments with maize, which will be continued, were undertaken for determining the effect of dicalcium and tricalcium phosphates, and of Obolus sandstone in a medium consisting of pure sand with the addition of a varying fertiliser having respectively a physiologically alkaline, neutral, strongly or slightly acid reaction. The best results were obtained with dicalcium phosphate, for the sandstone only gave fairly good results when the soil had a strong acid reaction ; thus practically it scarcely pays to use Obolus sandstone as a fertiliser for maize.

For this reason, the author agrees with those investigators who maintain that different plants have different powers of assimilating crude phosphates and slag, but the capability of plants of the same family is very similar in this respect. Of those examined, buckwheat manifested the greatest power of assimilating phosphoric acid, followed, in descending order, by Leguminosae (the vetch being superior to clover), Cruciferae, flax, and finally the Gramineae. These differences led the author to divide plants into two groups according to whether they *break up or consume* phosphoric acid. The inherent power of disintegrating the phosphoric acid can however be increased by supplementary fertilisers with a physiologically acid reaction. It is hoped to be able to determine by means of further experiments whether this inherent power of breaking up phosphoric acid depends upon differences in acidity of the root secretion of plants, as is held by PFEIFFER, SIMMERMACHER and SPANGENBERG, or upon some other factor (2).

988 - **A Comparative Study of the Consumption of Sodium Nitrate.** — CALICHE, Year III, No. 4, p. 3. Santiago, Chile, April 1921.

The Table reproduced on pp. 1240-1241 gives (according to the pre-War geographical conditions), the supposed future capacity for consuming sodium nitrate in the chief agricultural countries. The calculations are

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(1) Contrary to the statement in *R* No. 291, March 1921. (*Ed*)

(2) For root-acidity as a specific and family character, and for the relation between Leguminosae and Graminae, cf. JOVINO: "Le Leguminose contro la siccità," in *Italia agricola*, Year 44, No 6, p. 136. Piacenza, March 1917, and "Osservazioni sull'aridocoltura italiana," by the same author in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 52, p. 114. Modena, 1919 (*Ed*)

[988]

TABLE. — *World Consumption of Sodium Nitrate.* (See R No. 988).

Country	Year	Total area sq. km	Cultivated area hectares	Cultivated area where nitrogenous fertilizers are neded hectares	Sodium nitrate used 1913-1914 metric tons	Sodium nitrate used per hectare of cultivated land kg	Amount of sodium nitrate per hectare of land requiring it kg	Possible future consumption of sodium nitrate metric tons
United Kingdom	1911	313 166	7 231 500	5 785 200	138 000	19.84	23.85	289 260
France	1910	529 773	23 946 000	16 755 200	354 200	14.78	21.14	837 760
Spain	1911	504 720	16 704 000	6 681 660	54 142	3.24	8.13	334 080
Holland	»	22 615	894 700	805 230	87 032	97.28	107.00	40 261
Belgium	1895	29 465	1 450 000	1 305 000	175 952	112.45	132.25	65 250
Italy	1911	286 797	13 706 400	6 853 200	65 780	4.79	9.59	342 660
Portugal	1912	89 141	2 338 800	1 169 400	—	—	—	58 470
Germany	1900	540 866	25 708 500	20 566 800	980 812	38.15	42.87	1 028 340
Denmark	1907	38 984	2 581 400	2 323 260	34 408	13.33	14.81	116 163
Sweden	1911	448 044	3 702 000	3 331 800	22 954	6.20	6.89	166 590
Serbia	1897	48 323	1 025 900	410 360	—	—	—	20 518
Rumania	1905	130 237	6 003 600	3 602 160	—	—	—	180 108
Russia	1911	5 174 919	99 495 900	19 899 180	44 528	0.45	2.24	1 084 959
Norway	1907	323 117	740 900	666 810	13 800	18.63	20.60	33 340

Total Europe and Egypt.		12 728 471	232 606 300	101 873 600	2 051 500	—	—	5 183 679
United States		7 705 542	118 944 500	35 083 300	567 024	4.78	15.89	1 784 107
Total	1899	16 705	1 044 800	940 320	14 904	14.27	15.84	47 016
Hawaii Islands.	1910	114 570	315 000	252 000	—	—	—	12 600
Cuba	»	757 650	2 495 000	998 000	2 668	1.06	2.67	49 900
Chile	»	2 953 750	17 994 300	1 799 430	76	0.00	0.01	89 971
Argentina	1911	382 570	7 141 200	4 284 720	36 018	5.04	8.40	214 236
Japan	»	35 862	762 700	610 160	—	—	—	30 508
Formosa	»	7 707 141	6 067 600	1 213 520	5 474	0.90	4.50	60 676
Australia.	1910	7 269 105	2 815 700	563 140	—	—	—	28 157
New Zealand.	»	1 226 020	1 370 445	274 089	22 632	16.51	82.56	13 704
South Africa	»	53 013	5 804 453	2 321 781	—	—	—	116 089
Java	»	824 061	1 215 668	243 133	1 242	1.02	5.10	12 156
Mexico								
British India.	1911	2 492 692	107 229 900	21 445 980	—	—	—	1 072 299
Lesser Antilles	1910	7 174	629 955	377 973	—	—	—	18 898
Total of different countries.		**16 840 813**	**154 886 721**	**35 324 246**	**83 014**	—	—	**1 766 206**
World Total.		**37 274 826**	**506 437 521**	**172 881 196**	**2 701 546**	—	—	**8 734 052**

based on the total and cultivated areas of each country, the cultivated area that may be regarded as requiring nitrogenous fertilisers, the total and unit consumption of sodium nitrate, 100 kg. per hectare being taken as the possible amount of fertilisers used. The fertilisers are calculated as nitrate of soda, reckoning one-half as nitrate consumed.

The nitrate required for industrial purposes has not been taken into account.

989 - **The Importance of Magnesium Sulphate as a Fertiliser.** — JACOB, A., in the *Chemiker Zeitung*, Year XIV, No. 56, pp. 445-447. Cöthen, May 10, 1921.

The problem of the fertilising action of magnesium sulphate is one of the chief questions confronting the agricultural chemist. It is, indeed, well-kown that " Patent kali, " the double sulphate of potassium and magnesium has long enjoyed high favour among Dutch agriculturists, especially as a fertiliser for potatoes and leguminosae, but it is probable that its reputation is due less to the absence of chloride (the fertiliser in question being preferred to potassium sulphate which also contains no chlorine), than to the stimulating effect of the magnesium. This fact has proved of additional interest on account of the almost complete failure of the potato-crops in 1916.

The data relating to the question are very scanty, if we exclude LÖW's researches and discussions on the part playd by calcium, and WILLSTAETTERS discovery that chlorophyll is an organic magnesium compound containing 30 % magnesium.

Since 1917, however, the German Potash Syndicate has been using magnesium in a vast series of manurial experiments carried out in Germany and Holland upon potatoes growing in different soils, the basal fertiliser consisting of 90 kg. nitrogen, 60 kg. phosphoric acid, and 200 quintals of potassium.

The magnesium fertiliser was applied in the form of 2.5 quintals of kieserite (monohydrated sulphate of magnesium) that is to say, in amount corresponding to the magnesium in an equivalent dose of sulphate of potassium and of magnesium. A comparison was made between nitrogen, phosphoric acid and potassium chloride on the one hand, and nitrogen, phosphoric acid, potassium chloride and magnesium sulphate on the other; as well as between nitrogen, phosphoric acid and potassium sulphate, on the one hand, and nitrogen, phosphoric acid, potassium sulphate, and magnesium sulphate on the other.

Thirteen times in the 39 experiments, the best crop of tubers was produced by plots fertilised with potassium chloride and kieserite, and 11 times by plots fertilised with sulphate of potassium and of magnesium; thus in 24 cases, the harvest crop was the result of the application of a potassic fertiliser.

The general averages of the yield were as follows: — Without potassium, 202 quintals per hectare; with chloride of potassium 244 quintals, with sulphate of potassium 250 quintals; with chloride of potassium and kieserite 253 quintals; with sulphate of potassium and of magnesium 253 quintals. In short, with the same amount of potassium, the addition of kieserite increased the crop, on an average, 5.2 quintals per hectare. This occurred so frequently, that it may be attributed in some way to the presence of the magnesium.

The starch content was also affected; thus, the average starch production per hectare calculated for 1917-1919 was:— Without potassium 37.1 quintals; with potassium chloride 40.1 quintals; with potassium sulphate 44.2 quintals; with potassium chloride and kieserite 41.5 quintals; with sulphate of potassium and of magnesium 44 quintals. Apart from the manifest superiority of the sulphate, it is noticeable that in 1917 and 1918 the favourable effect of the magnesium was more marked.

It is not suggested, that these experiments have succeeded in solving the magnesium question, which from the industrial and agricultural standpoints, still remains open. It can, however, be said that, under certain given conditions, the use of magnesium fertilisers may considerably improve the yield, and in the meantime, the question of magnesium should occupy the attention of those engaged in the potassium industry, as there is no doubt that there will be a great demand for magnesium fertilisers on the part of agriculturists, and preparations should be made in good time to meet eventual needs for magnesium sulphate. However, it still remains to be seen whether the means hitherto taken to solve this problem are the most suitable for the purpose.

Magnesium sulphate is chiefly found in the German potassic deposits but those of Alsace contain none. During the last years of peace, only 500 000 quintals were sold out of 7 million quintals of kieserite produced, whereas 2 million quintals were used for the preparation of potassium sulphate.

The double sulphate of potassium and magnesium was extracted as an intermediate product, but now the process is carried further, owing to difficulties in drying the compound and the double sulphate on the market is artificially prepared by mixing kieserite with potassium sulphate which entails a much larger consumption of kieserite.

990 - **Graft Hybrids.** — LO PRIORE, in *L'Italia agricola*, Year 58, No. 6, pp. 172-175, 1 fig. Piacenza, June 15, 1921.

The author mentions many cases of graft-hybrids recorded in Italy and other countries, and specially dealt with a medlar grafted on a hawthorn, which was described by MANARESI, (1) who gave it the name of *Crataegomespilus Manaresii*.

The author described the DANIEL method for producing graft-hybrids artificially (by removing the top of the scion), and suggests some theories as to their origin (2), which may be summarised as follows:—

Graft-hybrids are the result of a union between somatic cells belonging to the stock and the scion, and having the power of producing individuals of intermediate characters which are either fused or superimposed.

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(1) See *R.*, Sept., 1915, No 928. (*Ed.*)

(2) For fuller information see: G. LO PRIORE, *Saggio di Genetica sperimentale*, Turin, Unione Tipografica Editrice Torinese, 1920. (*Ed.*)

A similar state of affairs is frequently met with in ordinary grafts, and is shown by the sudden appearance of ancestral characters, especially when the grafted forms are complex hybrids with innate hereditary tendencies to numerous more or less profound variations. Thus in the same scion there may be variations of different origins, which are either intermingled or superimposed.

991 - **Effect of Salt Solutions having Definite Osmotic Concentration Values upon Absorption by Seeds.** — RUDOLFS, W. (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. XI, No. 4, pp. 277-293, tables 6, figs. 2, bibliography of 6 works, Baltimore, M. D., Apr. 1921.

This series of experiments was designed to determine to what extent salt solutions tend to resist water absorption by seeds and whether this influence has a direct bearing upon germination. The author presents data dealing only with that part of the work which has to do with rates of imbibition as these are influenced by the osmotic concentrations of the different solutions employed. The seeds comprised maize, soybeans, alfalfa, white lupin, spring wheat, water melon, field peas, Japanese buckwheat and rape.

Solutions of calcium nitrate, potassium carbonate, magnesium sulphate, monopotassic phosphate, sodium chloride, potassium chloride, sodium nitrate and a complete nutrient solution for plants were used. The osmotic concentration values of these solutions ranged in value from 0.001 to 7.0 atmospheres. The percentage of solution absorbed and the relative absorption quantities were calculated for definite periods of time, the control in distilled water being used as a unit.

There was a marked difference in the absorbing power of seed of different species. Seed of the leguminous type showed higher rates of absorption than the others. The highest rates are indicated for alfalfa, the lowest for maize. The rates were progressively retarded with an increase in the osmotic concentration values of the solutions which do not react with the seed substances to modify chemically the imbibing properties of the seeds.

Average absorption rates show an approximately linear relation to the osmotic concentration values of the solutions, decreasing with an increase in concentration except in dilute solutions.

Experimental evidence points to the conclusion that retardation of absorption rates is accomplished, through osmotic resistance offered to the penetration of water into the seed. Low osmotic concentrations appear to have a stimulating influence upon the absorption rates of the seeds of some species but not upon the rates of others. The physiological significance of these accelerated absorption rates in solutions of low osmotic concentration has not yet been determined. Increasing the length of time during which the seeds are in contact with the solution has a distinct effect on absorption, increasing the differences between the quantities absorbed from solution of low and from those of high osmotic concentration values.

902 - **Character and Productivity of Stalrag, a New Kind of Rye Obtained at Svalöf by Selection from the Stjernrag.** — LJUNG W. E., in *Sveriges Utsädesförenings Tiskrift*, Year XXXI, No. 3, pp. 95-101. Malmö, 1921.

The large-scale cultivation of Stjernråg (Star rye) and the crops it yielded in 1913, show that this variety may be regarded as marking real progress in the improvement of this cereal, which is superior to all the types hitherto grown including Petkuser.

Stjernråg has, however, one defect: the straw is long and not sufficiently strong. These drawbacks have been remedied by the discovering of Stålråg (Steel rye).

In 1911, the author found, in a plot of Stjernråg, one plant differing from the others in several characters, and also in its slightly longer culm. From this plant was obtained the line 0302, put on the market under the name of Svalöfs Stålråg.

From 1915-1920, comparative cultural tests were made at Svalöf, Ultuma, Tomby and Alnarp. The same results were obtained at Tomby and Alnarp confirming the superiority of the new type of rye. Only at Ultuma did it prove inferior to Stjernråg.

Cultural experiments were also carried out in different regions, and for periods of various lengths, to determine the value of the new variety as compared with Stjern, Petkuser, and other types.

TABLE I. — *Results obtained at Svalöf.*

	Yield in grain per hectare in kg.	Relative yield as compared with Petkuser = 100
Svalöfs Stålråg	4 385	109.3
» Stjernråg	4 232	105.5
» 0280	4 116	102.4
Petkuser	4 013	100.0
Svalöfs 0451	3 926	97.8
» selected Wasa rye	3 894	97.0
Schlanstedteråg	3 784	94.3
Bretagneråg	3 737	93.1
Midsommaråg	3 529	87.9
Wasa	3 410	85.0
Prof. Heinrich	3 405	84.8
Öst Gråråg	3 161	78.8

Ostergötland. — Stålråg here took the first place with an average yield of 2990 kg. during the period 1917-1920.

Kristinestad. — Here, however, Stålråg was slightly inferior to Stjernråg, the yields being 1973 and 2030 kg., respectively, in 1917-1920.

Malmö. — Results similar to those obtained in the above province: Stålråg 3523, Stjernråg 3563.

S. Alfsborg. — Stålråg again took the first place with 1940 kg. as against the 1000 kg. of Stjern, and the 1850 kg. of Petkuser.

Skaraborgs and Varmland. — In these provinces Stjern was superior to Stål but the differences were rather small.

Orebro. — Here Stål was first (2433 kg.) followed by Stjern (2353 kg.) and Petkuser (2234 kg.)

In short, Stålråg, on an average, proved slightly superior to Stjern, in all the comparative cultural experiments, and in some districts, its superiority was indisputable and remarkable.

This applies to the grain; for the other characters, viz., straw yield, grain percentage, weight per hectolitre, weight per 100 grains, and culm resistance, see the summary given in Table II where the culm resistance is recorded according to an empiric scale of values, going from 1 (very weak) to 10 (very strong).

Stål is inferior to Stjern in straw-yield owing to its shorter stems, but for this very reason the grain percentage is higher; indeed, in this respect, Stål is superior to all the other varieties examined.

From the standpoint of the quality of the grain, Stål, and Stjern are equal, but the culms of the former are stiffer. The resistance of Petkuser, Stål and Stjern to cold is about equal. They are very suitable to South and Central Sweden though they cannot be recommended for the Norrland.

The results of these experiments taken as a whole, warrant our regarding the new type Stålråg as a distinct step forward in rye selection, for this new product is quite equal to the most approved and widely-cultivated varieties.

TABLE II. — *Summary of results.*

	Shaw yeeld — per hectare in kg.	Shaw yeeld — as compared with Petkuser = 100	Grain percentage	Weight of 1 hectolitre kg.	Weight of 1000 seeds g.	Culm resistance (1 — 10)
Svalöfs Stål	6 516	100.2	40.2	72.9	31.2	8.0
» Stjärn	6 745	103.8	38.6	73.0	31.1	7.5
» 0 280 (of Prof. Heinrich)	6 292	96.8	39.5	73.5	28.2	7.8
Petkuser	6 501	100.0	38.2	70.7	31.1	7.4
Svalöfs 0 451 (de Schlanstedter)	6 222	95.7	38.7	72.1	28.4	7.4
Svalöfs föradlale Wasa	6 225	95.8	38.5	73.2	27.8	6.4
Schlanstedter	6 158	94.7	38.1	72.6	30.6	7.0
Bretagner	6 556	100.8	36.3	72.6	27.4	5.0
Midsommar	6 479	99.7	35.3	72.2	23.5	6.3
Wasa	6 283	96.6	35.2	70.4	26.9	7.0
Prof. Heinrich	6 167	94.9	35.6	72.1	29.6	8.0
Ösgöta gråråg	6 041	92.9	34.4	71.9	27.6	6.8

993 – **Experiments in Crossing Different Species of Barley in the United States.** — MALLOCH A. S, in *The American Naturalist*, Vol. LV, No 638, pp 281-286, figs. 2. Lancaster, Pa, May-June, 1921.

The results of crossing cultivated barley and the wild species *Hordeum nodosum* and *H. murianum*. The cross *H. vulgare pallidum* × *H. nodosum* was an entire failure, but 2 hybrids were obtained by crossing *H. vulgare trifurcatum typica* with *H. murianum*. The contrast in the characters of the two parents was very distinct. The low and often recumbent habit of growth of *murianum* was contrasted with the relatively tall and erect habit of *vulgare*. The spikes of the wild barley are compressed, and composed of a number of relatively short and wide spikelets, which form rather a loose head, whereas the ears of the cultivated species are formed of somewhat short and wide spikelets; in fact, there are a large number of morphological differences between the two.

The two F_2 hybrids grew slowly and died after reaching the respective heights of 4 in. and 2 in. The seedlings were remarkable from the fact, that the sheath or coleoptile had a greater circumference than the blade, thus fitting loosely around it, instead of adhering closely as in *Hordeum vulgare*

Thus the crossing was successful, but the resulting hybrids were incapable of normal development.

The author explains this circumstance by the theory of reaction systems. When an attempt is made to combine 2 distinct reaction systems (such as evidently exist in cultivated barley and the wild species), an inharmonious group is often formed, which fails to function in a normal manner, so that as soon as the food material in the seed is exhausted, the plant dies.

994 – **The Transmission of the Character "Resistance to *Heterodera schactii*" in Barley.** — NILSSON EHLE, H, in *Hereditas*, Vol I, 1920, pp. 1-34. Summarised in *Nordisk Jordbrugsforskning*, Part 3, pp 113-115. Copenhagen, 1921

The greater, or less resistance of different varieties of barley to the attacks of *Heterodera schachtii* is of considerable importance in rotations where barley is followed by oats, for as is well-known the latter is much injured by these parasites.

If the barley belongs to a resistant type, the number of the nematodes present in the soil decreases, but if, on the other hand, it happens to be of a susceptible variety, the pests increase greatly and constitute a serious danger for the oat crop which follows the barley.

Oats sown after Chevalier (resistant) produce a crop exceeding by 59 % that obtained when they are preceded by Prinsess (very susceptible).

The degree of resistance possessed by barleys is therefore of the greatest practical and economic interest.

From this point of view, they may be divided into 2 categories, viz., resistant (or nearly resistant), and susceptible. No intermediate degrees and values are found between the two extreme types, such as occur in similar cases; this would seem to show that resistance to *Heterodera*, is due to the presence and action of a single genetic factor.

In order to study this question, the author crossed Chevalier I and Chevalier II (both resistant varieties) with Prinsess (susceptible). The F_1 hybrids proved resistant, therefore this character appears to be dominant.

In the F_2, though the experiments had been carried out under somewhat unfavourable circumstances, a large preponderance of resistant plants was obtained.

Some of the lines of the F_3 were resistant, others susceptible, and others again, were composed of susceptible and resistant individuals, with a preponderance of the latter.

If, as was suggested above, resistance is determined by a single factor, F_3 must contain resistant types, composed of resistant and susceptible individuals, and susceptible types in the ratio 1 : 2 : 1. In the cross Chevalier I × Guldkorn, the proportion is 26 : 42 : 16, which very nearly corresponds to the expected ratio.

The existence of one distinct genetic factor makes it possible to increase the amount of resistance by means of suitable selection and crossing, but it must not be forgotten that yield must be combined with resistance. As a rule, the most resistant types are the least productive.

995 - **Shrunken Endosperm and the Relation of this Character to the Factors Determining the Structure and Colour of the Endosperm.** — HUTCHISON C. B., in *The Journal of Heredity*, Vol. XII, No. 2, pp. 76-83, figs 5. Washington, February 1921.

Maize with shrunken endosperm is only a variation of the ordinary type. The kernels, instead of being smooth and round, as is usual in normal, starchy kinds, present cavities and indentations recalling those found in sugar maize.

In the latter, however, the indentation is due to the contraction of the starch, whereas in the shrunken kernels, a cavity is usually found within the upper cells of the endosperm, as if the cells, in that region had not been filled with starch. When the maize arrives at maturity and the kernels begin to dry, the top or sides sink in, thus closing the cavity, and it is this that makes the characteristic indentations.

By self-crossing, hybrids were obtained with the abnormal character. When these shrunken maize plants were crossed with ordinary types, the F_1 seeds produced were absolutely normal. Evidently, shrunken endosperm is due to a single recessive mendelian character, this may be distinguished by **sh**, and the dominant allelomorph may be expressed by the symbol **Sh**.

In two F_2 progenies, there were 705 normal and 239 shrunken kernels; this is very close to the 3 : 1 ratio expected. The fact that the genetic factor **sh** (**Sh**) is linked with the determinants of aleurone colour and structure is extremely interesting. A homozygous shrunken plant with red aleurone **CC sh sh** was crossed with another with colourless aleurone and normal kernel. An F_1 individual of this cross, grown in the greenhouse during the winter of 1918-19 was selfed; and on an ear thus obtained, there were coloured and colourless non-shrunken kernels, but all the shrunken kernels were coloured. This clearly indicates that there is a linkage of characters. To establish the fact, definitely the author made a number of back crosses between F_1 plants and the double recessive **CC sh sh**. Twenty-eight of the ears thus back-crossed produced offspring, and their kernels (8326) were distributed as follows:

Coloured non-shrunken . .	136	Colourless non-shrunken	4049
Coloured shrunken	3092	Colourless shrunken	148

These data show, that the factors, **C** and **sh** (**c** and **Sh**) are linked, that is to say, they occur in one chromosome in such a manner, as to be always transmitted together. As, however, out of 8326 kernels, 284 showed the combinations coloured-non-shrunken and colourless-shrunk, the linkage is not perfect. This is due to the phenomenon known as crossing-over in which the chromosomes divide, and the products of the division unite with one another in such a way, as to produce an actual exchange of determinants.

The rupture takes place at a point in the chromosome between **C** and **sh** (and respectively between **c** and **Sh**).

The cross-over percentage is 3.4. In order to determine the linkage relation of shrunken endosperm and waxy endosperm a ***non-shrunken waxy*** plant of the constitution **Sh Sh wx wx** was crossed with a shrunken starchy one, **sh sh Wx Wx**.

Several F_1 plants were back crossed to double recessive, **sh sh wx wx**, individuals, and 12 ears thus produced, containing a total of 2105 kernels distributed as follows:

Non-shrunken-starchy . . .	229	Shrunken starchy	833
Non-shrunken waxy. . . .	813	Shrunken waxy	230

Here there is clearly linkage between the starchy and shrunken structure of the endosperm (and similarly between the waxy structure and the normal condition of the endosperm). The cross-over percentage in this case is 21.8.

The factor **I** inhibits the development of the colour of the aleurone. The cross **II Sh Sh** × **ii sh sh** was made, and colourless kernels with normal endosperm were obtained. Several F_1 plants produced by these kernels were back crossed to the double recessive, and produced 28 ears, with a total of 7294 kernels distributed as follows

Coloured non-shrunken . .	134	Colourless non-shrunken	3525
Coloured shrunken	3509	Colourless shrunken . . .	126

Here we also have evidence of linkage, with a cross-over percentage of only 3.6.

996 - **Potato Improvement by Hill Selection in U. S. A.** — STEWART G., in *Utah Agricultural College Experiment Station, Bulletin* No. 176, pp. 3-28, figs. 14. Logan, Utah, Nov. 1920.

In 1911, a number of the highest and also of the lowest yielding hills were selected and isolated from the Majestic, Bangor and Peerless varieties, then being grown at the Utah Experiment Station. In 1912 the tubers from each hill were cut into sets weighing approximately 2 or 3 oz. and containing on the average 2 eyes. The sets were planted about 15 in. apart with rows 3 ft. apart. At harvest time each hill was dug separately and the tubers isolated and later weighed etc. About half of the best hills from the best progeny-rows and a few high yielding hills from other good rows were chosen. In poor selections, the lowest-yielding hills were used as seed. This method of selection was continued from 1912 to 1919, and is being continued still further and supplemented. Except that the poor selections were discarded in 1916, and after 1914, Bangor and Peerless stocks were also discarded on account of inferiority in yield.

The experiment was so conducted as to avoid selection for somatic characters and to secure selection for gametic qualities. This was done by growing all the best strains for 2 or more years in order to get a progeny test of the power of a strain to transmit its desirable qualities to the succeeding generations.

By 1915 the high yielding strains yielded an average of 301.03 bus. per acre as compared with 179.30 bus. per acre for unselected. From 1915 to 1920 the selcted strain has outdistanced the unselected stock of the same variety by more than 100 bus. per acre, except in 1919 when there was a difference of only 29.6 bus.; (this wide fluctuation may have been due to the extremely unfavourable growing season of 1919). In 1920, however, the superiority of the selected strains manifested itself, outyielding the unselected strain by 168.6 bus.

Taking the 6-year average 1915-1920, the acre yield of the selected strain was 60.9 % greater than that of the unselected, and the average size of tuber 24.4 % greater.

The germination of the selected strain is more rapid, the stand is better. the growth thriftier, and diseases less apparent than for the unselected potatoes of the same variety. .

A degenerate strain of highly chlorotic foliage has been isolated, but this could not be traced to any diseases.

997 - **Autofertility, Autosterility and Parthenocarpy in Certain Varieties of Fruit.** — STÅLFET, M. G., in *Sveriges Pomologiska Förenings Årskrift*, Year 22, Part 2, pp. 52-55. Stockholm, 1921.

Results of a series of experiments undertaken in 1919, in order to study the phenomena connected with autofertility, autosterility, and parthenocarpy. Several varieties of apple, plum, pear and cherry trees were examined, and classified as follows: —

AUTOSTERILE. — *Apple-trees*: Belle de Boskoop, Bismark, Rossviksäpple, Cox's Pomona, Skovfogdeæble, Signe Tellisch, Arreskov, Wellington, Sävataholm. *Plum-trees*: Ottomansk Kejsarplommon, Reine Claude. *Cherry-Trees*: Ostheimer.

PARTIALLY AUTOSTERILE. — *Apple-trees*: Hampus, Lane's, Prince Albert, Åkerö, Sommarkryddäpple, Boiken.

AUTOFERTILE. — *Pear trees*: Beurré Diel. *Apple trees*: Mank's Codlin, Brunsäppel, Tompipping, Peasgoods makalösa, James Grieve. *Plum trees*: Bonne de Bry, Stormirabell fr. Metz, Althanns Reine Claude.

PARTHENOCARPIC: Lord Grosvenor.

PARTIALLY PARTHENOCARPIC: Keswick Codlin.

998 - **A Large Collection of Wheats in Italy.** — LISSONE, E. G. (Direttore della Cattedra ambulante di Agricoltura di Saluzzo), in the *Giornale di Agricoltura della Domenica*, Vol. XXI, No. 5, p. 195, 1 fig. Piacenza, June 19, 1921.

The author mentions a collection, made by Sig. VINCENZO STEVANO of 3,000 varieties of wheat coming from all the countries of Europe, Africa, and America. These wheats have been bred by Sig. STEVANO in his experiment field at Savigliano (Saluzzo); many of the varieties quickly became acclimatised, and produced very fine grain.

After some trials, the author has convinced himself that certain foreign wheats, if acclimatised, and bred in Italy, would be successful beyond all expectation. The following Table gives the results obtained from plots of about 100 square metres during the agricultural year 1918-1919, with unselected seed of the 2nd crop (1917), or of the 3rd crop (1918).

Results of growing foreign wheats, or wheats from other regions of Italy.

Origin of wheat	Year of production of seed	Yeld of grain in quint. per hectare		Date of ripening	Preceding crop
		in 1919	in 1918		
Hungary	1918	26.4	—	June 24	Two year clover
Hungary	1918	26.9	50	July 1	Two year clover
Sicily	1918	40	31	June 27	Kitchen-garden plants
Rumania.	1917	36.6	44	June 26	Maize
Rumania.	1918	38.1	36	June 28	Peas and beans
Concepción (Chile). . . .	1917	32	44.9	July 1	Potatoes
Rumania.	1917	23.9	—	June 28	Potatoes

The yield of these wheats (32 quintals per hectare on an average) was much larger than that obtained in the neighbouring fields. This shows how thoroughly the introduced varieties had become acclimatized, and suggests, that excellent results could be obtained from them by selection.

In 1919, Sig. STEVANO was awarded an honorary diploma in France with the following inscription "For the creation and cultivation of the largest collection of wheats in the world".

999 - **Observations on the Wheats of Libia.** — SCAETTA, H., in the *Giornale di Agricoltura della Domenica*, Vol. XXXI, No. 30, p 235, figs 3, Piacenza, July 24, 1921.

The indigenous varieties of Libian wheat have very excellent qualities (1) the surest means of increasing their development and yield have still to be discovered. That is to say, it is necessary to determine :— The best ways of working the land ; the most suitable date for sowing ; the amount of seed per unit area ; the sowing method ; the best subsequent cultivation. It has been stated that it is useless to plough deeply in Libia, seeing that the native, who has cultivated cereals for centuries, has always used a rudimentary plough, and never seen any necessity for altering his primitive technique. It has further been said that deep ploughing encourages straw-growth to the detriment of grain production.

The large-scale experiments made by the author at Derna have demonstrated the undoubted superiority of deep ploughing (18-20 cm.), executed with a modern implement, as compared with the rude efforts of the Libian agriculturist. The beneficial results are, however, not very noticeable in the first year, as the ground has practically to be cleared, but are most recognisable in the 3rd and 4th years. Other conditions being equal, the best time for ploughing is before the rains.

Early sowing, at the beginning of the wet season, or even before, has nearly always been successful. Broadcasting (with 35-40 kg. of seed per hectare) is to be recommended, on account of the free tillering of the best Libian wheats (Mogarbia and Misko). In a dry country strong tillering is much to be desired, especially as it is associated with greater development of the root system.

The natural inclination to tillering has been greatly encouraged by moulding up, which makes the outside culms grow almost as much as the central ones. By this operation, the food supply of the grain is increased, and a heavier crop obtained. In fact, in some of the oases in South Tunisia and Algeria, the natives both earth up and hoe their wheat.

In Libia, wheat is encouraged to tiller by the mildness of the winter, which allows it to grow uninterruptedly until the spring, when the sudden rise of the temperature, together with the prevalence of the warm south winds, induce it to shoot up rapidly. This is the critical period for the crop, and every effort must be made to keep the ground moist, and increase the absorption capacity of the plants.

When a bad season is anticipated, wheats with a short vegetative cycle, moderate tillering and average yield (such as Screisra and some Tripolitan varieties) should be chosen, but when it is difficult, or even impossible, to forecast the weather, the colonist will do well not to confine himself to one single variety, but to sow several, selecting some with a longer vegetative period and high yield, and others with a short growing period and a lower, but more certain, yield.

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(1) See *R.* March 1921, No. 282. (*Ed.*)

1000 – **Trials of Strampelli Wheats in Italy.** — JOSA, G., in *L'Italia Agricola*, Year 58, No. 6, pp. 163-171, figs. 6 Piacenza, June 15, 1921.

Strampelli wheats (1) can be divided into 3 groups:— 1) Types for intensive cultivation, suited to North and Central Italy; in this group, there is only " Carlotta Strampelli "; 2) types for dry climates; these have been created chiefly for the Apulian region ; the chief varieties are " Apulia ", " Cervaro ", " Dauno ", and " Luigia Strampelli "; 3) more recently-created varieties for which the best environment has not yet been determined ; here belong Varrone, Ardito, Riccio, Bersagliere, and Potenziani.

As " Carlotta Strampelli " had been widely tested, and always with success in North and Central Italy, the author wished to try it also at average in the Southern Apennines where the climate is not excessively dry, the soil of the plateaux or of the regularly-sloping hills is moist, and where there are artificial meadows, and agricultural operations are carefully carried out. Prof. AZIMONTI (2) has already tried this wheat with complete success in the High Valley of the Agri in Basilicata. Equally satisfactory results were obtained by the author, as is shown by the following figures giving the yields of Carlotta Strampelli and the other varieties tested.

Test at Campobasso (altitude 680 m). — Hilly ground, well-prepared; the wheat followed a manured maize crop; complete fertiliser with superphosphate and sodium nitrate in the spring:— Carlotta Strampelli, 15.40 quintals per hectare ; Noé 14.70 ; March wheat 6.90.

Test in the Commune of Boriano (altitude 500 m). — Damp, fertile plateau soil; the wheat followed manured maize: – Carlotta Strampelli, 12.5 quintals per hectare ; local Solina, 9.15 quintals.

According to the description furnished by the " Stazione di granicoltura di Rieti ", the above-mentioned wheats for dry climates had the following characters:—

Apulia comes from the cross Rieti + Awned Spelta. The ear is white, smooth, glistening, slender; the awns are thin, scarcely 5-6 cm. in length, and parallel to the axis. Fertile spikelets 19 to 23 in number, with strong, well-closed, keeled glumes provided with a short, triangular, pointed beak. The kernels number from 31 to 46 per ear, and are reddish in colour, convex, pointed, with entirely starchy fracture. Weight of 1000 grains 47.5 gm. ; weight of hectolitre 80.6 kg. This wheat is excellent for bread-making. Used in the proportion of 79.20 % (bolter No. 120). It is a variety that does not shed its seed easily

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(1) See G. PATANÈ, The Selection of Cereals in Italy, in *R.*, June, 1916, pp. 777-787 ; *R.* Feb 1919, No. 152 ; July-August 1920, No. 732 ; Sept. 1920, No. 851 ; Oct. 1920, No. 956 ; Nov.-Dec. 1920, No. 1079. For tests of other varieties in Molise, see *R.* July 1921, No. 718. See also: N. STRAMPELLI. Su alcuni risultati conseguiti mediante l'ibridazione e la selezione delle piante agrarie, in *Atti del LVIII congresso degli agricoltori italiani*, April 1918. — IDEM, Breve riassunto dei lavori della R. Stazione sperimentale di agricoltura a Rieti; in *Bollettino della Società degli agricoltori italiani*, Oct.-Nov. 1918. — IDEM. Altre varietà di frumento ottenute nella Stazione di granicoltura di Rieti. Piacenza, Federazione italiana dei Consorzi agrari, 1920. (*Ed.*)

(2) EUGENIO AZIMONTI : *I grani dello Strampelli nel Mezzogiorno* Piacenza, Federazione Italiana dei Consorzi agrari, 1920. (*Ed.*)

Collataral tests of Strampelli wheats for arid climates.

Places where tests where made. Commune of:	Varieties tested	Grain yield quintals per hectare
Campomarino	Apulia	9.86
	Cervaro	10.60
	Dauno	14.31
	Luigia Strampelli	10.36
	Bianchetta	11.30
	Saragolla	14.90
Guglionesi	Apulia	11.02
	Cervaro	8.08
	Dauno	8.18
	Luigia Strampelli	6.50
	Bianchetta	6.50
	Caccavone	6.66
Portocannone	Apulia	5.90
	Cervaro	6.11
	Luigia Strampelli	6.67
	Bianchetta	4.73
Portocannone	Apulia	4.44
	Cervaro	4.38
	Dauno	5.34
	Luigia Strampelli	4.09
	Bianchetta	6.52
	Saragolla	7.16
Rotello	Apulia	7.29
	Cervaro	7.80
	Dauno	7.98
	Luigia Strampelli	5.90
	Bianchetta	13.50
Rotello	Apulia	6.43
	Cervaro	6.43
	Dauno	5.50
	Luigia Strampelli	6.98
	Bernarda	6.78
Santa Croce di Magliano (Melanico)	Dauno	9.23
San Martino in Pensilis	Apulia	6.50
	Cervaro	10.30
	Dauno	7.50
	Luigia Strampelli	10.30
	Rioccola	11.40
	Saragolla	10.60
Termoli	Apulia	6.00
	Dauno	7.50
	Bianchetta	7.80

[1008]

Cervaro was obtained from a mixture of hybrids sown in 1908 in Capitanata, and chosen from plants that resisted the drought of that year. It is soft, has tall straw, abundant leaves, is awnless, white, and smooth. Kernels very large. Flour return very high. Requires rather deep soils.

Dauno comes from the same source as Cervaro. Hard, with fawn-coloured, smooth, compact ear, and strong awns 14-17 cm. long, which adhere to the ear. Glumes with pronounced keel and triangular short beak. Kernels 36-50 per ear, 18-22 fertile spikelets. Fracture wholly flinty. Weight of 1000 grains 47.6 gm. Weight of hectolitre 79.6 kg. specially suited for making alimentary pastes, etc.

Luigia Strampelli has the same origin as the two preceding wheats. It is soft, has a white, smooth, awnless ear, with some sign of very short awns on the external glumes near the tip. Glumes with prominent keel and blunt beak. From 18-22 fertile spikelets per ear; 36 to 52 kernels per ear, fracture starchy. Weight of grains: 76.8 kg. per hecto litre. It gives 82 % of excellent flour for bread-making.

According to the author, Apulia and Luigia Strampelli appear to be somewhat susceptible to rust, and have a tendency to lodging on soil that is richer than usual. Dauno is hardy and drought-resistant, as well as less exacting in its requirements than most hard wheats.

The wheats for dry climates were tested under precisely the same cultural conditions as those under which cereals are grown in Apulia, viz., they were sown after base fallow, or an annual crop of leguminosae which had received a dressing of superphosphates or ploughed in without manuring. The seed was broadcast, 130 kg. being used per hectare. The results obtained are given in the accompanying Table (page 1254).

The year these experiments were carried out (1919-1920) was particularly unfavourable to the growth and ripening of wheat, but as on an average, other years have been no better, the above results cannot be regarded as exceptional. According to them it appears that, in arid climates, the Strampelli wheats are not markedly superior to the local varieties.

Dauno can even be mistaken for one of these varieties, red Saragolla, or Saragolletta, which is cultivated in the Lower Apennine district of Capitanata (the ancient Daunia), and in the lower part of Molise.

1001 - **Topping of Wheat.** — SUCCI, A., in *L'Italia agricola*, Vol. 58, No. 7, pp. 197-204 figs. 4. Piacenza, July 15, 1921.

For some decades, the author has made observations upon the growth of wheat, and during several years in succession, he made direct experiments with a view to ascertaining the effect of topping.

In 1917-1918, he carried out his experiments on VILMORIN wheat (a variety which is resistant to lodging), at 3 different stages, in order to be able to cut back either the two basal leaves, the two central leaves, or the two apical leaves, respectively. The times selected were:—

1) When the tallest stalks, with their leaves, when extended, measured 50-55 cm.; the lowest internode being developed and the second just visible (April 17).

2) When the tallest stalks, with their extended leaves, measured 85 cm., and the two first internodes were completely developed (5 cm.

and 6 cm. from the top), as well as all the blades, except the one at the top of the plant (May 2). At this time, the wheat was cut back twice, to 30 and 40 cm. respectively above the level of the ground.

3) When the apical shealth began to grow turgescent from the formation of the ear or, as the peasants say, " takes the form of a spindle " (May 17).

In any case, only the laminae were clipped, and these were cut just above the ligule of the highest stalks. The injurious effect of topping is shown by the following Table.

Effect of topping wheat at 3 different periods.

		Topped April 17		Topped May 2			Topped May 17	
				Topped				
		Topped	Control	to 30 cm.	to 45 cm.	Control	Topped	Control
Weight of 100 grains	gm.	3.9	4.8	3.3	4.3	4.4	3.3	4.3
Number of grains per ear . .		29.0	39.0	25.0	26.0	32.0	31.0	33.0
Weight of grains per ear . . .	gm.	1.10	1.79	0.83	1.12	1.41	1.02	1.42
Length of ears	cm.	8.4	9.2	7.3	7.6	8.3	8.9	8.7
Aborted spikelets per ear . .		3.8	2.2	6.0	5.3	3.4	4.1	4.0
Length of stalk	cm.	115.4	123.6	111.6	123.5	128.4	124.0	130.0
Length of fully-developed laminae								
2 apical laminae . . .	cm.	66.7	66.8	39.8	54.6	66.5	28.7	65.1
2 central laminae . .	»	51.2	73.4	4.6	25.7	70.7	74.0	75.8
1 vasal lamina	»	9.1	26.0	12.5	24.3	28.0	27.0	28.0

These results prove that topping constantly decreased the average yield of each stool, either by reducing the number of kernels in each head, or by lessening the unit weight. Less harm was done by the second topping (May 2). The chief effect of the early topping (April 17) was to reduce the number of kernels, and the last one (May 17) chiefly caused a diminution in the weight of each kernel.

The decrease in the weight of the grain following the first topping took place at the expense of the size and not of the nutrition of the grain, whereas by the 3rd topping, it was typically the nutrition of the grain that was affected.

The decrease in the number of grains must not be attributed to a variation in the number of the axils of the stalk (which is a character differing according to the variety and is independent of growth conditions; thus the lodging resistant VILMORIN has 2), but to the number of fertile spikelets, this being one of the characters most easily affected.

It is interesting to consider the effect of topping upon lodging (1).

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(1) See R., July-August 1920, No. 741. (*Ed.*)

The French authors agree that topping increases resistance to lodging, but SUCCI thinks that their conclusion is somewhat hasty, for this effect may be obtained by: — 1) Strengthening the base of the stalk; 2) reducing the weight of the leaves and ears. In SUCCI's experiments, topping had the second effect, but not the first. The operation of May 2 certainly increased the resistance of the wheat to lodging, but at a heavy price. It is very doubtful whether the advantage obtained counterbalanced the decrease in the yield and the inferior quality of the grain, seeing that the 1st topping reduced the yield by 38 %; the second diminished it 20 % or 41 % (according to whether the stalks were cut back to within 45 or 30 cm. of the ground), while the third, not only reduced the quantity of the yield by 28 %, but also had a bad effect upon its quality (1).

In any case, the topping, that is likely to give the best results, that is to say, to do the least certain injury and confer the maximum benefit, is the one carried out on May 2, when the laminae only were cut, and these to within 45 cm. of the ground. This agrees with what long experience has made the general practice, where it is the established custom to top wheat in order to increase its resistance to lodging.

1002 - A New Method of Determining the Increased Yield of Permanent Pastures in Germany.

— SCHUBERT, Bericht im Sonderauschluss fur Wiesen und Dauerweiden in *Mitteilungen des Deutschen Landwirtschaftsgesellschaft*, Year XXXVI, Part 22, pp 338-339. Berlin, May 28, 1921.

There are always considerable difficulties in evaluating pastures, and especially in determining the effect produced upon them by fertilisers, because the grass crop can only be estimated indirectly by the condition of the grazing stock. This is the chief cause of error, as the individual peculiarities of the animals, are seldom taken sufficiently into account.

Many methods are used for comparing areas of pasturage that have been manured and treated differently. The most usual is to divide them into plots of the same size and to make the lots of grazing animals as homogeneous as possible.

The great difficulty in such cases is the choice of the stock, for few animals are alike in their power of turning their food to best account. "Futterverwertung", or making most use of the pasture "Weideausnutzungvermögen". Further, such experiments are often interfered with by the withdrawal of some of the animals (either on account of sickness or other causes), especially if the herds happen to be small. Other factors affecting the experiments are variations in temperature, drought, etc., to which animals react differently.

The author tried another experimental method at Nesshof (Kaibsheim, Würtemberg), and used only one herd of animals, which grazed the different plots in succession. By this means, all errors due to dissimilar utilisation of the forage were eliminated, and it was only the after-effects of the latter «Futternachwirkung» on the time of passing from one lot to another that could interfere with the results of the experiment; further, these could be lessened by moving the stock from plots that had been little manured, to others which were in a good condition.

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(1) Cutting back wheat with a sickle has a very variable effect upon its lodging, according to the date at which the operation is carried out. SUCCI found that rather early topping increases the tendency to lodge. — See: A. SUCCI, La falciatura primaverile del frumento coltivato per seme, in *L'Italia agricola*, 1912, p. 331.

The method is as follows:— The enclosed plots to be grazed in succession must be as similar as possible in physical condition, taking the state of the vegetation into account. The herd chosen ought to be accustomed to the pasture for at least 14 days before the beginning of the experiment. The grazing results are estimated in the first place by weighing the animals and measuring the milk yield. The calculation is completed by estimating FALKE's "Weidetagseinheiten" (daily grazing units), i. e., the amount of forage required to produce 100 kg. of live weight in 24 hours ; by this means, it is easy to detect any possible defects in the pasture. Supposing, for instance, that for some reason, the herd has to graze on one of the experiment plots longer than was intended, the increase in live weight and the milk yield must unfailingly diminish without the productivity of the pasture being necessarily lower. In such a case, the daily grazing units will prove that the pasture has produced more grass in proportion to the longer time the stock has been kept on it.

The conversion of the "Weidetagseinheit" into money value is unnecessary since the pecuniary return is sufficiently shown in the calculation of increase of weight and milk yield.

Site of the experiment and fertiliser per hectare	Area in hectares	Yield per hectares			Quintals of live-weight maintained for 150 days on 1 hectare	Value of increased weight, in marks	Value of milk produced at 0.20 marks per kg.	Total cost of the fertiliser, in *marks*	Increased yield, after deducting the cost of nitrogenous fertiliser, in *marks*
		"Weidetags einheiten"	Increase in weight quintals	Amount of milk, kg.					
Mühlfeldweide 6 . 6 quintals of kainit at 3.40 *marks* per quintal, 6 quintals of basic slag et 5.80 *marks* per quintal	14.43	1965	0.52	2530	13.1	104	506	55.2	—
Mühlfeldweide 3 . . 6 quintals of kainit, 6 quintals basic slag, 1.5 quintals sulphate of ammonium at 29.20 *marks* per quintal	4.62	2515	0.47	3260	16.7	92	652	99.0	90.10

The accompanying Table gives a summary of the data obtained in 1916 in an experiment made with milch cows to determine the effect of manuring with a nitrogenous fertiliser, and demonstrating that practical results can be obtained by this method.

1003 – **A Comparative Study of the Composition of the Sunflower Maize Plants at Different Stages of Growth** (1). — SHAW, R. H., in *Journal of Agricultural Research*, Vol. XX., No. 10, pp. 786-792, Bibliography of 7 works. Washington, D. C. February 15, 1921.

The sunflower plant is gaining recognition as a silage crop in certain of the northwestern States where climatic or soil conditions are not always favorable for the maturing of maize for silage purpose. In some sections also there is a growing feeling that sunflower silage offers a more profitable feed than maize silage, because of the greater yield that may be obtained per acre.

The Dairy Division is making an investigation of sunflower silage. This paper, which is the first of a series, presents the results of a study of the chemical composition of the sunflower plant at several different and distinct stages of its growth as compared with that of maize grown under similar conditions. The purpose of the study is to assist in selecting the proper stage of maturity for ensiling.

Tables I and II give the results of the chemical work on the whole plants. The figures for total protein, albuminoid protein, reducing sugars, non-reducing sugars, and starch are based on the dry matter.

TABLE I. — *Composition of sunflower plant at different stages of growth.*
(Giant Russian Variety).

Stage of maturity	Moisture in fresh material	Dry matter	Moisture free basis				
			Total protein	Albuminoid protein	Reducing sugars	Non reducing sugars	Starch
	%	%	%	%	%	%	%
3 feet high	84.87	15.13	8.59	8.00	12.36	19.08	0.63
6 feet high	86.02	13.98	8.01	7.37	18.95	15.63	4.61
First flower.	84.09	15.91	7.04	6.35	15.96	8.43	4.34
Rays ready to fall. .	83.90	16.10	9.44	7.89	13.23	3.01	0.20
Rays dry and partly fallen	75.58	24.42	6.80	6.22	8.96	1.40	0.84
Rays all fallen . . .	74.37	25.63	7.03	6.09	6.99	0.89	1.66
Seeds hard and mature	69.68	30.32	5.90	5.04	4.15	1.47	1.90

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(1) See *R.*, April 1919, No. 493; *R.*, October, 1920, No. 1008, *R.*, March, 1921, No. 289; August 1921, No. 819. (*Ed.*)

TABLE II. — *Composition of maize at different stages of growth.*
(Boone County White Variety)

Stage of maturity	Moisture in fresh material	Dry matter	Moisture free basis: Total protein	Albuminoid protein	Reducing sugars	Non reducing sugars	Starch
	%	%	%	%	%	%	%
3 feet high	84.21	15.79	11.14	10.26	14.69	2.73	1.52
4 $^1/_2$ to 5 feet high .	85.14	14.86	9,42	8.14	16.69	3.23	1.66
Just tasseling . . .	81.65	18.35	9.90	6.59	13.13	1,85	1,29
Just silking	81.56	18.44	8 95	6.73	18.23	1.30	0.86
Kernels forming . . .	81 20	18.80	8.99	6 38	20 37	5.14	3.45
Milk stage.	77. 0	22.40	8.97	6.30	17.59	4.51	2.87
Silage stage (one half. milk, one half glazed)	68.69	31.31	7.31	6.23	10.03	2.81	24.00
All glazed	64.22	35.78	6.32	5.62	8.50	5.39	24.78
Ready to shock . .	59.79	40.21	7.09	6.14	7.71	2.73	21.66

The dry matter in each increased gradually and consistently throughout the entire period of growth.

There is no great difference in the percentage of proteids in the two plants, but it is slightly in favour of the maize.

The reducing and non-reducing sugars in the sunflower declined somewhat irregularly but persistently during the growth of the plant. In the first stage there was about one and one-half times as much non-reducing sugars present as reducing sugars. This relation was quickly changed, and in the latter stages the reducing sugars exceeded the non-reducing.

The percentage of starch in the sunflower is small and rises and falls irregularly throughout the growth of the plant.

The reducing and non-reducing sugars in the maize plant rise and fall but with a marked upward trend during the growth of the plant until the stage is reached there the kernels are maturing, when a sudden drop occurs. The percentage of reducing sugars is always far in excess of the non-reducing sugars.

The starch rises and falls until the kernels are maturing, when a sudden rise occurs.

The chief difference between the two plants at the silage stage lies in the amount and character of the carbohydrates.

From the results obtained in this study it would seem that the best stage of maturity for ensiling the sunflower plant is when the rays of the flower have become dry and are falling.

1004 - **Note on Some Recent Researches on the Cotton Plant in the West Indies with Special Reference to St. Vincent.** — MASON, T. G. (Imperial Department of Agriculture), in *West Indian Bulletin, Journal of the Imperial Agricultural Department for the West Indies*, Vol. XVIII, No. 4, pp 181-197, pl. 2, Tables 3, bibliogr. of 5 works. Bridgetown, Barbados, 1921.

Report of series of investigations carried out in St. Vincent under the direction of S. C. HARLAND to ascertain the factors which limit the yield of seed cotton in the West Indies. The methods adopted were to a large extent those employed by Dr. L. BALLS in Egypt; graphical methods were extensively used, and the results subjected to statistical treatment.

I. — LIFE HISTORY. — In an attempt to secure precise knowledge of the relative importance of the factors controlling: *a*) The number of buds produced by the plant; *b*) the number of buds becoming flowers; *c*) the proportion of flowers producing bolls, HARLAND undertook to trace the life history of the cotton plant in St. Vincent. For 3 seasons (1916-19) the number of flowers and bolls opening daily in each of the manurial plots was determined and the records presented in graph form, and from them the average flowering and bolling curves for the 3 seasons were constructed.

Inspection of the flowering curves of the 3 seasons shows that they all commenced at the end of the 9th week from sowing. The date on which the first flower appeared, however, was in every case the 57th day after sowing, but the rate of flower production was not sufficiently large to be indicated in the curve till the end of the 9th week. The uniformity of this interval is most remarkable; it will be evident that it is independent of the variations which occur in the weather from season to season, and therefore it is in no way correlated with the factors determining the rate of vegetative growth of the plant.

The commencement of the bolling curve is 7 weeks later than that of the flowering curve, and a similar period separates the dates of their respective crests.

. In estimating the number of bolls from each plot, a separation had to be made between diseased and healthy bolls. The convention adopted was to count as healthy only those which were less than half diseased. The factors responsible for the fluctuations in figures during the 2 seasons are referred to later.

This phase in the investigations has produced some useful information which may be summarised as follows:— 1) If the date of sowing be known, it can be estimated with certainty when most flowers and bolls will be produced, and when the crop will be finished; 2) practically 50 % of the June-July planted crop may be lost through bud-shedding; 3) during the 51 days of the life of the boll, the period of greatest susceptibility to shedding occurs in the first 3 weeks,.

II. — MANURIAL EXPERIMENTS. — Twenty-four plots (3 series of 8 and $\frac{1}{40}$ acre each) received the same treatment year after year. The nature of the treatment, and the mean yield of seed cotton per acre is given as follows:— nitrogen as sulphate of ammonia (30 lb. per acre) 607 lb.; phosphorus as basic slag (40 lb. per acre) 607 lb., potash as sulphate of potash (30 lb. per acre) 730 lb., phosphorus (40 lb) + potash (30 lb), 856 lb.; nitrogen (30 lb.) + phosphorus (40 lb.) + potash (30 lb), 609 lb.; cotton seed meal (600 lb. per acre), 593 lb.; cottonseed meal + phosphate + potash, 733 lb.; no manure 514 lb. This shows a % gain over no manure of +18, +18, +42, +28, +30, +15, and +42 % respectively. It is pointed out that the disease known as red-leaf in St. Vincent is most prevalent on the plots receiving no potash (1) (This has been conformed in America). Manures, however, seem to have no effect whatever on the time of maturing of the crop.

III. — ENVIRONMENT. — According to BALLS, the formation of the absciss layer which precedes the shedding of both buds and bolls is most probably brought about by a water deficiency, and as a consequence, this shortage prevailed whenever the loss of water by transpiration from the leaves exceeded that absorbed by the roots. Some recent investigations on the premature dropping of young fruits of the Washington Navel orange (HODGSON R. W. *Univ. of California Publication in Agricultural Science,* Vol. III, pp. 37-54, Sept. 1917) and HARLAND's experiments indicate that the same factor is probably responsible for much of the shedding of buds and bolls in St. Vincent; practically 50 % of the June and July planted crop was lost in 1916-17 from bud shedding and also in 1918-19.

It has been clearly demonstrated that the periods of heaviest rainfall were followed by enormous shedding of both buds and bolls, but the interpretation of the relationship between the intensity of the rainfall and shedding is, however, less thoroughly established.

IV. — FUNGUS DISEASES. — As shown above, the 50% loss from shedding of buds is practically all due to physiological causes (occasional exceptions due to external boll diseases (*Bacterium malvacearum*). Of the remainder of the potential crop 50-60 % is lost annually from the effect of diseases and physiological shedding of bolls. An estimate of the relative importance of these two factors cannot yet be formed, but an examination of the condition of certain bolls, which dropped in November 1916, is of interest:— affected by internal boll disease 64 %; affected by external boll disease 21 %; healthy bolls 14.8 %. The loss, therefore, sustained from fungus diseases, cannot be considered as important a factor in reducing crop production as the physiological factors.

V. — SPACING EXPERIMENTS. — Apparently the production of flowers is decreased if the outer nodes are suppressed by close planting. — HARLAND undertook a series of experiments, in which 2 plants per hole instead of the normal 1 plant, were left in alternate rows. Results showed that though the production of flowers per plant was not sensibly altered by this spacing, yet the number of bolls per unit area was 26 % greater.

VI. — COMPARISON BETWEEN EXPERIMENTS IN ST. KITTS (2) AND ST. VINCENT. — Manurial experiments have now been in operation in St. Kitts for some 17 years, conducted by F. R. SHEPHERD, on lines very similar to those in St. Vincent. The results are, however, of an entirely different nature. It may be noted that the yield of seed cotton in St. Kitts may exceed that obtained in St. Vincent by as much as 60 % in a normal year, and unlike the latter, a second picking is frequently obtained

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(1) See *R.*, April 1919, No. 461. (*Ed.*)

(2) See *R.*, Feb. 1919, No. 197. (*Ed.*)

Up till now the effect of fertilisers on St. Kitts' land was negligible, but they begin now to have a larger significance.

A comparison between the flowering curves for 1917-18, and 1918-19 shows a striking similarity between the form of curves for the two islands, indicating a distinct resemblance between the life history of the plants.

Precise data as to the amount of loss sustained from bud shedding is not available for St. Kitts, but, according to available information, the loss from bud and boll dropping is much less here than in St. Vincent. The most potent factor determining the loss from physiological shedding is evidently in St. Kitts environmental aridity, whereas in St. Vincent it is the reverse; it is, however, evident that the loss of the major part of the crop in both cases is through physiological shedding. The explanation of the differences in the amount of shedding in the 2 islands is not apparent. A factor which may be partially responsible is the spacing in St. Kitts where there are 5 300 plants to the acre compared with 4356 in St. Vincent. The loss from diseases is relatively small in St. Kitts.

1005 - **General Survey of Rubber Situation in 1921.** — GIRARD, M. E. (Administrateur délégué des Plantations de Suzannah et d'An-Loc; ancien Président p. i. du Syndicat des Planteurs de Caoutchouc de l'Indochine), in *Bulletin des Caoutchoucs de l'Institut Colonial de Marseille,* Year 1921, No. 2, pp. 37-48. Marseilles, 1921.

The author emphasises the fact that it is unreasonable to suppose that former rubber plantations are likely henceforth to prove worthless as a result of the present industrial crisis, and that it is improbable that the latest market sale prices at present below the cost price in the majority of the plantations will last indefinitely. In fact it is logical to imagine that probably the excessive rates will tend to limit the length of the critical period, and that a rise in market price may be counted on, certainly before the end of 1922, and perhaps sooner if the planters cooperate in the rectification of matters.

YIELD OF RUBBER. — The check to the extension of rubber plantations, due to the depreciation in sale price of rubber following directly on the appreciable reductions necessitated through the war naturally has an important bearing on future prospects. In addition to this, unlike the crude products coming from other trees and shrubs taken as a whole, the *Heveas* never give sufficient rubber to make planting a paying proposition until the trees are several years old. To rectify the present state of affairs will, therefore, take some years.

For some time yet, the area planted with *Heveas* will remain limited to the existing 3 000 000 acres (1 200 000 hectares) in the various countries suited to its cultivation; and it is hardly probable that new trees can be planted at a reasonable cost for at least another 10 years, and even then as has been noted above it would be some years later before the yields from these newly planted trees would have any effect on the market prices.

The method of daily tapping employed continuously on the same plantations has often been followed by diseased bark and finally the destruction of the trees. This accounts to some extent for the decrease in production at present, and indicates the probability of a still further decrease: doubtless this will be altered in due course, but very gradually. It may be deduced from these facts that the maximum yield has already been reached and that now the average yield taken as a whole for plantations where daily tapping is employed, will be only about 290 kilos per hectare. Exceptional plantations certainly exist, and as much as 500 to 600 kilos have been obtained but a radical change in methods of exploitation will be necessitated to make this a general rule. Considering the time taken to effect this change, the total yield expected for the next few years from 800 000 to 1 200 000 hectares is estimated at from 240 000 to 360 000 metric tons.

Excluding the probable decrease in production hitherto mentioned, the following approximate estimate has been determined referring to the total world production of rubber (in metric tons): — 1921, 320 000; 1925, 385 000; 1929, 530 000; 1932, 670 000.

CONSUMPTION OF RUBBER. — In collective data with reference to the consumption of rubber it has been estimated that taking the production in 1921, including rubber consigned on arrival, that purchase directly on important private stocks which are due to be liquidated in consuming countries and also the enormous quantities of manufactured goods used previous to and during 1921, the total consumption amounts to approximately 350 000 metric tons.

The average annual rise in consumption during the last six years was 20 %; but no more than 10 % can be counted on for some time.

Estimates based on these calculations are as follows: — (in metric tons): — 1921, 350 000; 1925, 511 000; 1929, 746 000; 1932, 992 000.

These moderate estimates with reference to the consumption for the years 1921 to 1932 do not, however, correspond with the possibilities of production under the most favourable circumstances M. GIRARD, therefore, bases his estimates for consumption, on the reduced production rate, i. e. taking 270 000 metric tons as the total production for 1921 instead of the amount indicated in the production estimated (see above).

Following this system of calculation and the average annual rise in consumption as 10 % the following estimate is obtained.

	Consumption	Production
1921	270 000	270 000
1925	495 000	390 000
1929	720 000	530 000
1932	958 000	670 000

The present crisis could certainly have been prevented if the planters had made adequate previsions before hand, and it is believed that the return to the normal state of affairs will be hastened if they adopt exploit-

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ation methods as advised and which it appears will be put forward shortly.

In order to facilitate the verification of the figures of the numerous published statistics, the following tables have been compiled to show the world production 1900 to 1920 and the area covered with rubber plantations : —

TABLE I. — *World rubber production* 1900 *to* 1921.

(Reproduced from "*Le Caoutchouc et la Gutta-Percha*", No 190, Dec. 15, 1919.)

Year	No. of plantations	Brazil	Other countries	Total	Difference %
1900	4	26 750	27 138	58 890	—
1901	5	30 300	24 545	54 850	+ 1.7
1902	8	28 700	23 632	52 340	— 4.5
1903	21	31 100	24 829	55 950	+ 6.8
1904	43	30 000	32 077	62 120	+ 11.0
1905	145	35 000	27 000	62 145	+ 0.04
1906	510	36 000	29 700	66 210	+ 6.5
1907	1 000	38 000	30 000	69 000	+ 4.2
1908	1 800	39 000	24 600	65 400	— 5.2
1909	3 600	42 000	24 000	69 600	+ 6.4
1910	8 200	40 800	21 500	70 500	+ 1.2
1911	14 419	37 730	23 000	75 149	+ 6.5
1912	28 518	42 410	28 000	98 928	+ 31.6
1913	47 610	39 370	21 452	108 440	— 9.6
1914	71 380	37 000	12 000	120 380	+ 11.0
1915	107 867	37 220	13 615	158 702	+ 31.8
1916	152 650	36 500	12 448	201 598	+ 27.0
1917	213 070	39 370	13 258	265 698	+ 31.1
1918	200 950 (2)	30 700	9 929	241 579	— 9.0
1919 (1)	339 000 (3)	33 000	10 000	382 000	+ 51.1
1920 (1)	350 000	30 000	10 000	390 000	+ 3.0

(1) Estimate. — (2) Amount exported. — (3) Including 55 000 tons from 1918.

Apparently the percentage rise in production for 1901 to 1911 inclusive was on the average 3.1, and from 1912 to 1920, 23.9 and for the entire 19 year period, 11 %. There was practically the same development as regards consumption, but this showed only a rise year by year. With the introduction of mechanism, electricity and increase in comforts in general it will rise in proportion to the demand.

Tracing the rise and fall as regards production, the increase from 1915 to 1920 has been regular which is worthy of special notice, but the difficulties in exportation in 1918 engendered a restricted market of goods.

Consequently, difficulties in freightage have led to the belief in an immediate absorption capacity which in reality does not exist at this moment venig to discount limitations. It is, without doubt, this erroneous estimate which has led to the idea of exaggerated stock in America and in

TABLE II. — *Area planted with rubber (in acres).*

	Total per year	General Total	Yearly increase %
	tons	tons	
in 1905 and previously planted	116 500	116 500	—
» 1906 » » »	117 700	294 200	139.6 %
» 1907 » » »	212 350	506 550	72.1
» 1908 » » »	180 800	687 350	35.6
» 1909 » » »	173 800	861 150	25.3
» 1910 » » »	261 400	1 122 550	30.3
» 1911 » » »	382 800	1 505 350	34.1
» 1912 » » »	312 000	1 817 350	20.7
» 1913 » » »	204 400	2 021 750	11.2
» 1914 » » »	159 300	2 181 050	7.8
» 1915 » » »	112 700	2 293 750	5 2
» 1916 » » »	165 200	2 458 950	7.2
» 1917 » » »	152 400	2 611 350	6.2
» 1918 » » »	148 600 (1)	2 759 950	5.6
» 1919 » » »	130 000 (1)	2 889 950	5.0
» 1920 » » »	110 000 (1)	2 999 950	4.0

(1) Estimate.

Europe, which adds to the balance of accumulated production on the plantations and in the warehouses and in the ports of the Far East. Rubber despatched in 1919, has, owing to the industrial crisis, and its consequences, provoked an unexpected overcharge in the second half-year of 1920.

TABLE III. — *Exportation of rubber from various countries.*

Country	1920	1919	1918	1917	1916	1915
Ceylon and India	37 500	43 000	23 000	25 000	23 500	20 600
Malay Pennisulas	187 800	219 000	134 000	146 000	102 000	72 800
Java*	30 500	35 000	17 300	19 000	14 000	7 500
Sumatra*	21 000	26 000	12 900	13 200	8 700	6 200
Gross Totals	**276 800**	**324 000**	**187 200**	**203 200**	**148 200**	**107 100**
* Less export via Singapore, to subtract	10 300	15 200	15 400	2 900	2 800	1 300
Net Totals	**266 500**	**300 800**	**171 800**	**200 300**	**145 400**	**105 800**
	—	—55 000	—55 000			
Corrected errors		**245 800**	**226 800**			

DISTRIBUTION UP TO DATE OF THE WORLD RUBBER PRODUCTION 1915 TO 1920. — The statistics relative to the world rubber production 1915 to 1920 are here given (reproduced from *Le Caoutchouc et la Gutta-Perhac* Yr. 18, No. 204. Feb. 15, 1921):

The total production from rubber plantations does not include the production in Cochinchina, nor in the Philippines nor in other countries where rubber is grown on a limited scale, amounting to a maximum total of 800 to 1000 tons in 1915 and to about 5000 tons in 1920; the area of these plantations is not included in the Tables indicating the area utilised and the yield per acre.

TABLE IV. — *Average total yield per acre* 1915 *to* 1920.

	Total production	Total area covered	Yield per acre
	tons	acres	kg.
1915	105 800	1 122 550	94
1916	145 400	1 505 350	96
1917	200 300	1 817 350	110
1918	226 800	2 021 750	112
1919	245 800	2 181 050	112
1920	266 500	2 293 750	116
			aver. 108 kg.

In closing, the author states that the apparent low average total production per acre may be explained by the enormous differences in yield capacity of the various plantations, due largely to the age of the trees, the type of soil, cultivation, climate and general methods employed.

In some cases, areas included in the statistics have become disused before the age fixed for exploitation; others tapped on intensive lines at 3 ½ to 4 years, have not been utilised after a certain number of years, at the moment when they should have reached under normal conditions, their maximum yield.

It should not be forgotten that by adopting the daily tapping system early, after 5 or 6 years for examplé, the yield per hectare should normally vary from 50 to 600 kilos in 10 successive years, but generally the yield amounts to 20 to 240 kilos or 12 to 160 kilos per acre (30 to 300 or 400 kilos per hectare) for 7 years, prior to decrease. After 7 years and also 10 years (less frequently), as a result of the daily tappings made up till now, the rate of production decreased with much more rapidity when efforts were concentrated on maintaining the yield percentage by intensifying the area tapped as regards depth or frequence.

This variation is not only confined to rubber but to produce taken as a whole.

With due consideration of all these facts M. GIRARD considers that logically speaking these estimates of production and consumption of rubber from 1921 to 1932 correspond in all probability to possibilities.

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1006 - **Variability of the Camphor Yield in *Cinnamomum Camphora*** (1). — DUNN, S., T. in *Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information*, No 4. pp. 129-135. London, 1921.

The existence of worthless as well as valuable camphor trees has for a long time been recognised by the camphor distillers in China, Japan, Formosa, Cochin-China, and other places where *Cinnamomum Camphora* Nees, was exploited as a wild or cultivated tree. The same phenomenon began to appear however, in newly made plantations and numerous enquiries on the subject have been received at the Royal Botanic Gardens, Kew. Requests were sent to the various Colonies where aberrant trees grew, asking that experiments might be made and that specimens and full notes on their plantations might be sent to Kew.

Notes have here been made as a result of these enquiries, and also with reference to recorded experiences of former practical exploiters as to the variations in the yield of camphor trees.

Causes of variation. — The direct cause of the presence in the camphor tree of essential oils of varying constitution and quality is to be found probably in the formation within the plant of terpentinol (C_{10} H_{16}) which is gradually changed by the activity of the living cells into camphor (C_{10} H_{16}). It is not surprising therefore that the yield of camphor varies from month to month. The cause of variation in the recorded yield of a tree in the Government plantation at Curepipe in Mauritius is suggested to be the time of the year at which the leaves were clipped for distillation. If there is any other circumstance affecting the healthiness and cell activity of *C. Campora* it will on the above theory affect the yield of camphor. This supposition is supported by the microscopic examination of the specimens of wood from the experimental plantations in Mauritius, made by BOODLE at Kew.

According to reports from Formosa, the northern climatic conditions favour the production of solid camphor, and in the south, this is to a large extent replaced by the Sho and Yu-ju oils. The climate of Florida has the effect of encouraging the same species to produce solid camphor mixed with an oil differing from the Japanese oils in its low percentage of safrol (HOOD and TRUE).

The remarkable variation of camphor content in the leaves of trees growing under different conditions of shade and soil has been reported both from the United States and from Ceylon. CARMODY (formerly Director of Agriculture in Trinidad) has drawn attention to a case where transplanting caused small trees to recover and produce a normal quantity of camphor (April 10, 1920).

From these observations it is obviously important to consider in the first place the situation most suitable for the camphor tree and also to find by experiment the best time for clipping the leaves.

There is also another line of enquiry that may lead to useful results, viz. as to the existence of botanically distinct camphor yielding varieties, for example, the smell of crushed leaves is noticed to resemble that of camphor on trees yielding that substance, whereas the " oil tree " leaves a smell of turpentine or eucalyptus. The Chinese are said to differentiate between the valuable and worthless trees in Formosa by this means. Whether this is a permanent character is not quite clear.

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(1) See *R.* May 1920, No. 528; R. March 1921, No. 194. (*Ed.*)

Slight colour variations of the leaves have also been noticed but otherwise no visible varietal characters can be found in any part of the tree to separate " camphor " from "oil" trees. " The occurrence of the so-called oil and camphor trees side by side in the same district suggests that there may be individual peculiarities which affect the chemical products of camphor trees without being accompanied by any corresponding outward characters. Such physiological characters are known to exist with other plants e. g. *Hevea brasiliensis* (*Ann. Bot.* XXXIII, p. 313) and *Acacia Catechu* Willd. (GAMBLE, *Manual of Indian Timbers* 2nd ed., p. 297 and *Revue de botanique appliquée.* No. 1, 20. (1921).

Suggested lines of improvement. — From these statements it is evident that in order to produce plantations which can be relied upon to give good quantities of solid camphor: 1) Seed should be secured from trees known to produce camphor. The author states that it is probably available in Hong-Kong (see *Report on Botanical and Forestry Dept.* Hong-Kong, 1919); 2) Suitable climate and soil are necessary; 3) Saplings must be planted so that they may be clipped conveniently. Extracts made from *Camphor Cultivation* by HOOD and TRUE (*Yearbook Dept. Agric. U. S. A.*, 1910, pp. 453-455), show that on the Department's experimental plots the trees are planted in rows 15 ft. apart and 6 ft. apart in the row, and are grown to an A-shaped hedge 8 ft. high and 8 ft. wide at the base. At 6 years from the seed the trees will form a solid hedge in each row and will be thick and bushy to the ground. The best months for clipping must be ascertained by experiment, as observations show considerable changes in the camphor content of the leaves as the growing season advances.

As regards propagation, HOOD and TRUE advocate propagation by seed in preference to cuttings, if grown for commercial purposes, and sowing on hills 3 ½ × 1 ½ ft., with 3 seeds to the hill, and covered about 2 in. deep. This method requires about 24 quarts of seed per acre, and will produce enough trees for setting out 16 acres of field planting. The percentage of germination is very low and only about one-half the seeds may be expected to grow. Cultivation should begin as soon as possible, and as soon as a full stand is obtained the plants should be thinned to 1 per hill and a good dressing of high-grade fertiliser given.

The first season the plants should make a growth of 12 to 18 in., with a very large and vigorous root system. The treatment in the 2nd year should be the same, and at 26 months from seeding the plants should be from 2 to 3 ft. high and well branched, and are ready for field setting. Deep ploughing in the early autumn and before the trees are set is advised; they are first cut back severely, the taproot cut to 12 in. and all small laterals removed.

It is recommended that small crops, such as cotton, peas, etc. be grown between the rows for 2 or 3 years, and cultivation should be thorough and frequent.

Extracts are also given with reference to information received from EATON in the Federated Malay States (*Bulletin* 15. *Dept. of Agric.*, pp. 10-11) who advocates the soaking of seed for 24 hours before sowing. The heavy seeds which sank to the bottom were sown by themselves in rows 3 in. apart each way, and ¼ in. below the surface. The light seeds were sown broadcast as only a few were expected to germinate.

1007 - **Hop-Growing Experiments in South Africa.** — BAKER, E. (Botanist, Elsenburg School of Agriculture, Mulders Vlei), in *Journal of the Department of Agriculture, Union of South Africa*, Vol. III, No. 1, pp 27 33, pl. 14. Pretoria, July 1921.

While it is evident that many efforts have been made from time to time to grow hops in South Africa, very little has been reported as to the success of these attempts, and the author here traces the progress made since 1902 up to the present time.

The hopsets obtained in 1902; and 1905-1907 from England, Germany and America failed to establish themselves; those imported in 1913-1915 are still living and even though not yet proving an economic success, improvements in cultivation methods etc., may change the present state of affairs.

The author describes the hop experiments at George in 1917-1920 with the cultural methods employed. The object in view is to demonstrate that a sufficient return of green hops per acre can be obtained to make the cultivation of the crop an economic success. A good field of dried hops is estimated at anything from 10 cwt., per acre upwards; at George the drying process accounts for 65 to 75 % of the weight of the green crop, the average showing that about 100 lb. of green hops yield 30 lb. dry weight. Thus far some of the sections in the experiments at George have given returns from 2-year old plants of from 7 to 8 cwt. per acre; these plants should be in full bearing next season, when it is hoped that improved yields and more reliable returns will be obtained. The District of George, with climate and conditions similar to those found in parts of Europe where hops are grown, gives promise of being the most suitable part of the Union of South Africa for this purpose.

The ground used for experimental purposes consists of a sour, shallow, sandy soil, which is inclined to become water logged in certain portions for short periods every year. Results showed, however, that good drainage is essential to the growth of hop plants.

In England the practice is to apply from 20 tons, or in some cases as much as 30 to 50 tons of farmyard manure per acre, but as in George it is impossible to obtain adequate supplies, it is proposed to use, instead Karroo sheep manure at the rate 2 ½ tons sheep manure per acre in plots previously receiving 5 tons farmyard manure, and at the rate of 5 tons sheep manure per acre in plots previously receiving 10 tons farmyard manure.

To make up for the deficiency in organic mater it is suggested that green barley, or green barley and vetches might be grown as winter cover crops, and ploughed in about mid August.

While it is probable that the best mixtures of artificials have not yet been found, it is proposed for the present to continue to supplement the kraal manures with the mixtures as used during the past 3 years (bone meal, superphosphate, blood meal, etc.).

The author gives details of the cultural methods employed, viz. setting out, cutting, poling, tying and training, cultivation, picking and dryings.

The practice at George has been to use sets from underground shoots (" runners " or "suckers"), as it has been found that they give more vigorous plants. The older hills are cut or pruned early in August before the new growth has commenced. The hills are opened up, and the straps (i. e. remains of previous years bines) are removed.

Up to the present the hops have been remarkably free from disease and insect pests. The only fungus apparent on living hops has been a leaf spot (*Septoria* spp.) which was found on a few plants about picking time at the end of February and early in March.

It seems from an economic point of view that the prospects of remunerative hop growing in well selected localities are worthy of consideration. There are still various points which need to be investigated and while it may now be definitely stated that hops can be grown satisfactorily in one part of South Africa at any rate, the author emphasises the fact that the fringe only of what may possibly develop into a staple industry has so far been touched.

1008 - **Vanilla Production in Mexico.** — *Journal of the Royal Society of Arts*, Vol. LXIX, No 3569, p 360. London, April 15, 1921.

Vanilla is principally cultivated in the districts of Papantla and Misantla in the State of Vera Cruz, the most productive region lying southeast of Tuxpan. At present Mexico employs over 50 000 people in the cultivation and extraction of vanilla.

According to the report by the U. S. Trade Commissioner in Mexico it appears that vanilla grows more or less in a wild state in the low hills, and is very abundant. It grows best in rich, sandy soil not drained too thoroughly. When growing wild it is usually sheltered by the forest trees, and when cultivated it is protected by trees planted for that purpose. The temperature most favourable for its production is about 85° F,; it grows best at an altitude of 1000 ft., above sea level; the character of the soil, the temperature and humidity, etc. influence the quality of the vanilla, its aroma, and its strength. The plant ripens most extensively in January and February. There is, however, so much demand foı the fruit that for many years crops have been prematurely harvested in October and November. As a result the beans weigh 1 lb. less per 1000 than they would normally. In compliance with orders from the Government, the authorities were formerly instructed to prevent the harvesting of unripe fruit, but this order has not been strictly enforced.

One of the great problems of the owners of vanilla plantations is to provide against the robbery of their crops.

For commercial purposes vanilla is divided into 4 classes:— large fine (weight 10 to 12 oz. per " mazo " (bundle) of 50 fruits, length 20 cm.); small fine (weight almost equal to large fine, length 10 to 15 cm.); zacate (heavier weight; grows more abundantly along the roadsides in the warmer regions of Mexico, where formerly its fruit was considered to be without commercial value); basura.

There are different varieties of vanilla in the vicinity of Misantla, known as Misantla beans, which have a coarse bark; also a wild bean "vanilla platano" which the Indians eat and which differs from the ordinary vanilla (*V. planifolia*) in that the plant is much smaller but has larger leaves.

Practically all of the exports go to the United States, for which reason the American dollar is the basis of price, both for buying and selling.

1009 - **Production of Cacao in Tabasco (Mexico).** — *Journal of the Royal Society of Arts.* Vol. LXIX, No. 3569, pp. 349-350 London, April 15, 1921.

The cacao of the State of Tabasco (Mexico) though one of the richest in flavour and nourishing qualities of all varieties in the world's market, is probably the least known. This is due partly to its restricted area of cultivation but chiefly to its remarkably high price in comparison with the South American and East Indian product. Villahermosa, in Tabasco, is the centre of production and the only market for the cacao beans in Mexico. The production for 1920 is estimated at 3 300 000 lb., the largest crop since 1913.

Mexican cacao, besides being of superior quality, is also far less bitter than other varieties. The U. S. Consul at Frontera states that for this reason less sugar is required in the manufacture of candies. etc. On the other hand, as Tabasco cacao is richer in fats and oils, it should be profitable for manufacturers to import it for the manufacture of cocoa and chocolate as beverages, or even as foods, since less cacao and sugar will be required per unit quality.

The native tree differs very little from other varieties. The beans are enclosed in a sort of shell, the " mazorca " which is crushed for their extraction. The fleshy pulp surrounding the seeds in the mazorca is washed out or separated from the beans, a process which entails the chief expense in the operation of harvesting the cacao. The beans are then dried in the sun, ovens not being in use. Only manual labour is employed in the cleaning process, but if a suitable machine for this work were introduced, thereby cheapening the process of extracting and drying the beans, it is possible that the export price could be reduced to the point where the product would be within the reach of foreign buyers.

1010 - **Experiments in Crossing Different Varieties of Fruit Trees of the Genus *Prunus* in Italy.** — RAGIONIERI, A., in the *Bollettino della R. Società toscana di Orticoltura*, Vol. XLVI, Nos, 5-6, pp. 36-41. Florence, May-June, 1921.

Although no results are obtained on crossing the apricot with Italian plum-trees, which are all derived from *Prunus domesticus* and *Prunus* *insititia*, the apricot can be successfully crossed with Japanese varieties of *Prunus*. It was in this way that Burbank obtained the " Plumcot " in California.

The author obtained negative results on crossing the apricot with the " Red June " American-Japanese plum-tree, or the Burbank plum-tree (a Japanese variety introduced and put on the market by Burbank, when either of these was the male parent. The results, however, were positive, if the latter variety was the female parent. The following hybrids were obtained :—

(1) Burbank Plum × Early Tuscan apricot
(2) » » × King Humbert apricot
(3) » » × Late Paviot apricot
(4) » » × White Nubian nectarine (Sprenger's)
(5) » » Violet nectarine
(6) » » × Early St. Anne peach
(7) » » × Poggio clingstone peach
(8) » » × Vetriciano clingstone peach
(9) » » × American Triumph peach

The author thinks that his experiments show that the Burbank plum-tree has very little sexual affinity with the European varieties of plum (except Reine Claude), whereas it has a strong sexual affinity with the apricots and peaches cultivated in Italy.

He concludes by giving some practical information about the technique of these crosses.

1011 - **Notes on the Cultivation of Citrus Fruits in the United States, Porto Rico, Rhodesia, India and Cyprus.** — I. Vosbury, E. D. (Office of Horticultural and Pomological Investigations), Citrus Fruit Growing in the Gulf States, in *Farmer's Bulletin No.* 1122. *United States Department of Agriculture*, pp. 3-44. Washington, D. C., Sept. 1920. — II. Kelley, W. P., and Thomas, E. E., The Effects of Alkali on Citrus Trees, *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* No. 318, pp. 305-337, tables 14. Berkeley, Ca., Jan. 1920. — III Shamel A. D., and Scott, L. B., Frost Protection in Lemon Orchards. *United States Department of Agriculture, Bulletin* No 821, pp 1-30, pl. 3, figs. 15 tables. Washington, D. C., June 4, 1920. — IV. Earle, F. S., The Cultivation of Citrus Fruits in Porto Rico, in *Government of Porto Rico, Dept. of Agriculture and Labor, Insular Experiment Station, Rio Pedras, P. R., Circular* No. 28. pp. 1-20. San Juan, P. R., Sept. 1920. — V. Turner, A. G., (Citrus Adviser), Citrus Industry (Report on Visit to California), in *The Rhodesia Agricultural Journal*, Vol. XVIII, No. 2, pp. 142-166, tables 5. Salisbury, Rhodesia, April 1921. — VI. Paranjpe, H. P., The Cultivation of Oranges and Allied Fruits in the Bombay Presidency, in *Dept. of Agriculture, Bombay. Bulletin* No. 95, pp. 1-23. Poona, 1920. — VII. Wittle, A. H., The Possibilities of Citrus Culture in India, in *The Agricultural Journal of India*. Vol. XV, Pt. IV, pp. 444-450. Calcutta, July 1920. — VIII. Citrus Trees. *The Cyprus Agricultural Journal*, Vol. XVI, Pt. I, pp. 10-12. Nicosia, Jan., 1921.

In nearly every article here referred to, apart from full cultural details, the history and present industrial situation in the various countries as regards citrus fruits is included. Certain points concerning only the selection of varieties, soils, propagation, pruning, etc. have here been selected for comparison purposes : —

I, II, III, V. — United States (1) : (*a*) *Gulf States* (especially Florida). Vosbury states that as a result of the demand for standardisation, a committee of prominent growers and nurserymen was appointed by the 1916 Citrus Seminar at Gainesville Fla., to recommend a short list of selected varieties. The orange varieties chosen as a standard were : — " The Parson " (Parson Brown) : the best known and most widely planted early variety : season early October to November. " Homosassa " : late November to February; " Pineapple " : late December to early March; " Valencia " : latest standard variety known : March to May; " Lue " (Lue Gim Goug) : late variety of recent origin.

The more recent varieties of grapefruits in Florida are largely confined to the standard named sorts, namely : " The Hall," midseason, February and March ; " Walters," midseason ; " Marsh " (Marsh Seedless), midseason ; " Duncan," late season, April to early June ; " MacCarthy," late season ; " Davis " (Davis Seedless), new variety, considered promising ; " Triumph," very early, but small and extremely seedy. Apart from Florida the " Duncan " (well adapted for colder sections), " Marsh " and " Walters " are the most popular.

The " Lisbon," " Villafranca," and " Ponderosa " are found to be the most productive lemon varieties in Florida.

As regards propagation (2), the sown orange (*Citrus vulgaris*) (stock) has been found vigorous, resistant to foot rot, and the trees produced thin skinned fine quality fruit. On light, dry-sandy soils in S. Florida, the rough lemon stock (*C. Limonum*) have given better results (except with Parson var.). The trifoliate orange (*C. trifoliata*) is the hardiest stock for citrus fruits in common use, but it is best adapted to the rich moist soils, sandy loams with clay subsoil and is unsuited to light dry soils (these have given unsatisfactory results in the Rio Grande valley, Texas, but very successful in Southern and Central Florida). As soon as the young trees are planted the tops are cut back to a bud at a height of 2 or 3 feet from the ground. Trees that are well pruned at planting and for the next few years, need very little pruning after they reach maturity.

In Florida the usual practice is to fertilise young citrus trees 3 or even 4 times annually. The first application is made in the spring when growth starts, 1 or 2 are made in summer and the last early in September. The spring and summer applications contain about 5 % of nitrogen, 6 to 8 % phosphorus and 2 or 3 % potash.

An interesting spray schedule for citrus trees (3) is given 'relative to the control of insect pests, etc. such as scab, rust mites, red spiders, thrips, white fly, scale, etc.

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(1) An instructive and detailed publication dealing with " Citrus Fruits and their Culture " has been written by H. H. Hume (Professor of Horticulture and Botany University of Florida). New York, 1915. (*Ed*)

(2) See *R.* Feb. 1921, No. 162. (*Ed.*)

(3) Reduced Acidity in Oranges Caused by Certain Sprays. See *R.*, June 1921, No 609. (*Ed.*)

[1011]

(*b*) *California*. — Turner reports that practically all plantings of oranges in California are of two main varieties, Navels (1) and Valencias (2), which are at the present time fairly evenly divided in point of acreage, but there are indications that lately Valencias (2) have been planted in larger numbers than Navels. It is claimed that at least 20 acre inches of irrigation water per acre is required for all citrus trees between April and November inclusive, and any district where this amount is not available is probably over-planted. Where dry season cover crops are to be grown, this minimum requirement must be increased to nearer 30 inches. In 1920, a total of 246,000 acres was planted (oranges, bearing 133 000, non-bearing 50 000; lemons, bearing 33 000, non-bearing 17 000; grapefruit, bearing 6000, non-bearing 7000.

The greater part of the acreage covered with citrus fruits in California is still irrigated from open distributories (made of cement or granite blocks, laid in cement with miniature sluice gates at each opening), taken down the steepest grades, on a level with the gradient of the hills, and not stepped at intervals, so as to lead out the still water, as is done in some places. The methods adopted of diverting water at outlets is to let a slot into the floor of the channel which leads directly to each little opening, and by this means to get a perfectly constant stream of water flowing over the orchards; another method used is to set a batten diagonally across the floor of the channel, so that the lower point is opposite the opening; this is also perfectly effective. It is considered that this older method is as efficacious as by using the underground stand-pipe system. An interesting experiment is in progress in one district where peat beds are being turned into orchards. A layer of peat and manure about 1 foot is thrown into the pit, then about the same amount of cull oranges and lemons; on which is distributed about ½ ton of basic slag. This is continued in the same proportions until the pit is filled; about 6 months are required for this to decompose and be ready for use. When applied to orchards, 10 cub. ft. is allowed per tree, placed in deep furrows in the centre of the rows.

Kelley and Thomas present a report of the results obtained in connection with a study of a considerable number of citrus groves in different localities in California, dealing with the effect of alkali and the relationships existing between orchard practices and the accumulation of alkali in citrus groves.

Experience in various localities has shown that under certain conditions, continued irrigation with comparatively pure water tends to hasten the accumulation of injurious amounts of soluble salts in the soil. In the presence of excessive concentrations of salts, especially chlorides, complete defoliation may take place. Mottling frequently occurs (1) and sometimes chlorosis. Both the quality and quantity of the fruit are impaired. The results of recent investigations establish the fact that some of the irrigation waters in use at the present time on citrus groves have a high alkali content and it appears that the most promising source from which a supply of really good water in quantities sufficient to meet the demands of the constantly expanding citrus industry can be obtained is only through concentrated effort directed towards the control of flood waters. By the use of suitable check dams, reservoirs, reafforestation etc. which will permit storage of mountain waters, an adequate supply of suitable water can probably be obtained.

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(1) See *R* Jan 1916, No 67 and *R.* May 1916, No. 507.
(2) See *R* Dec 1918, No 1347 (*Ed.*).

[10[illegible]]

III. — Extremely low temperatures during December 1912 and January 1913, caused serious damage and loss to unprotected lemon orchards in many sections of California, and SHAMEL, SCOTT and POMEROY (*Office of Horticultural and Pomological Investigations*) made a study of the effect of these low temperatures in the lemon district near Corona (about 5000 acres). The altitude under discussion is about 1000 ft. protected on the south and east by the Santa Anna Range of mountains (4000 ft). The objects of these investigations were: 1) the determination of the effectiveness of orchard heaters, as measured by the number, commercial quality, and value of the fruits, produced by lemon trees in orchards thus protected compared with those unprotected; 2) the determination of the length of time unprotected trees took to return to normal production; 3) the determination of the behaviour of lemon trees in heated and non-heated orchards the 2nd year after frost; 4) comparison between the frost injury in orchards of both Eureka and Lisbon lemon trees, the two most important varieties grown in California (2).

From the investigations it appears that the main effect of protecting trees during one season of low temperatures is in the saving of one crop for the current year, and that as a rule where the trees are in vigorous condition, and receive good cultural treatment, they will return to normal production at the end of one year. In unprotected orchards, under comparative conditions, a greater amount of injury was found in the Eureka than in the Lisbon variety. But this may be attributed to the fact that the latter has a denser foliage.

IV. — PORTO RICO. — Most of the older groves in Porto Rico are budded on rough lemon (*C. Limonum*) stocks (3) but the author considers that this is distinctly inadvisable except on soils very light and sandy where other stocks fail. Otherwise on old trees that are bearing heavily the quality of the fruit is normal, but it is doubtful if it ever averages as high grade as that grown on other stocks and is very liable to disease. The author considers that the wider use of the sour orange (*C. vulgaris*) is likely to give far more promising results. This last stock is best used exclusively on all heavy wet lands, but not on light, sandy soil.

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(1) See *R.* July 1918, No. 743. (*Ed.*)

(2) See *R.* June 1917, No. 539 and, *R.* April 1919, No. 451. (*Ed.*)

(3) Selection of stocks in Citrus propagation. See *R.* Feb. 1921, No. 162. (*Ed.*)

During recent years the native grapefruit seedlings have been attracting considerable attention as a stock, and both these and the sweet orange (*C. Aurantium*) have so far done well and are fairly resistant to disease. *C. trifoliata* has never been employed, and is unsuitable in this climate, except possibly for navel oranges.

Up to the present time, grapefruit has been more largely planted in Porto Rico than any other citrus fruit. These fall under 3 well marked types: 1) large seeded Duncan type, c. q. Walters, Pernambuco, Conners, Prolific, etc. 2) seedless. e. g. Marsh Seedless, and Howel's Seedless, etc.; 3) Triumph or native Cuban, including the Pineros, but this type should not be considered for commercial plantings.

Not enough limes are grown in Porto Rico for a comfortable local supply. As they do well on shallow, limestone soils, commercial plantings will have to be on the dry southern side, since limes are seriously injured by anthracnose in a moist climate. It would probably thrive well in the coffee district. The author considers there are also distinct possibilities for the cultivation of citrons, hitherto practically unknown in this country.

Few soils in Porto Rico are so rich that they will not require heavy annual applications of fertiliser to maintain a grove in full production. Up to the present the quality of the fruit has been affected by lack of phosphoric acid or excess of nitrogen (1). The following applications are advisable and effective when it is wished to obtain early fruit. December 15 to January 10 — 15 to 25 lb. per tree of basic slag or bone meal; also 1 to 2 lb. per tree sulphate of potash (except on clay soils) and 3 to 5 lb. per tree of nitrate of soda.

March 1 to 15 — 2 to 3 lb. per tree of nitrate of soda.

May 1 to 15 — 1 to 2 lb. per tree of nitrate of soda.

(The last may be omitted on rich lands).

This will necessarily have to be modified if the object is to hold back the crop for late spring shipment.

The most important and only really serious diseases may be summarised as follows: Scab fungus (*Cladosporium citri*) on grapefruit: the removal of useless wind breaks is advocated as trees in exposed locations are usually less injured; Stem-end rot (*Diplodia natalensis*); oranges suffer more than grapefruit. To ensure the future of the citrus fruit industry in Porto Rico, the author lays emphasis on several possible and advisable methods of improvement, etc.

V. — RHODESIA. — TURNER after his visit to California (see above) proceeds to draw comparisons between the citrus industry there and the present state of affairs in Rhodesia, especially as regards commercial transport of oranges, methods of control of disease, and irrigation systems. He considers the present system of ventilated hold stowage as used for oranges from Capetown to Europe absolutely inefficient and harmful to the future of citrus export from South Africa, and that the new system of fans throughout the ship to allow free ingress and egress of air would prove far more efficient and clear out the foul stale air which is extremely detrimental to the good carrying of fruit. A comparatively new system of wrapping and packing oranges has been tried with some success in California which would prove beneficial in Rhodesia. The separator wrap, which is a sheet of pliable card board, the size of a box and which was previously only perforated with radial cuts in regular formation, has been much improved this last season by deeply cutting at the edges, making the packing nearly automatic. It does not entirely wrap the fruit, but protects and holds it in place, and shows the packer exactly where to put the fruit Shipments to eastern markets and Canada have shown this method to have practical value. The author lays emphasis on the fact that the bulge pack system is evidently an essential point in holding the pack absolutely tight in transit, which is contrary to the belief held by authorities in the Union of South Africa who claim that the bulge is detrimental to the good carrying of oranges.

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(1) See *R.* Aug. 1918, No. 840, and *R.* Feb 1919, No. 173. (*Ed.*)

It is generally recognised that a 25 % coloured orange is fairly green, and that even 70 % is only light coloured. Although they both may have the necessary sugar content according to the law, the poor colour militates against the sale price, and in order to overcome this, a great deal of this early fruit is subjected to a gas treatment in closed chambers for a period varying from 2 to 3 days. On account of the danger from fire with the old method of gassing fruit for colour, and to comply with present insurance risks, the gassing plants should preferably be situated in separate chambers, apart from packing houses, and usually across the road. The gas is blown by motor fans through a galvanised iron tunnel or pipe into the sweating or gassing chambers in basements or on the floors of the packing houses. The gassing lasts for 24 to 72 hours, according to the matuity of the fruit, which is then ready for grading, sizing and packing.

The author considers that if it is desired to ensure the arrival of oranges in Europe in as good condition as Californian fruit arrives in its distant markets, every precaution should be used in Rhodesia known to be of value, in the picking, packing, railing and shipping operations. There is an opportunity in Rhodesia of getting very much higher net returns from orange growing than in the former, by reason of cheaper land, water, labour and transport facilities, if only the methods of organisation are well established.

VI — VII — India. — *Bombay Presidency.* — Citrus fruits are among the most paying crops in this district. Paranjpe places before the public the methods which have been found to yield the best results and give the largest profit, not only with oranges but also with other kinds of citrus fruits. The species commonly cultivated are: Grapefruit (*C.decumana*). Citrons :— *C. Medica* var. *limonum* (" Jamburi "), *C. Medica* var. *limetta* ("Sakhar limbu"), *C. Medica* var. *acida* (" Kdagi limbu ") and the orange

(*C. Aurantium*) including sub-species: 1) loose skinned Santra, Ladoo, Kawla and Reshmi Narang; 2) tight skinned "Mosambi."

The "Navel" var., "Malta Blood" var. and the Jamaica orange are occasionally found in gardens, but are not cultivated elsewhere.

The grapefruit or pomelo, thrives best in a moist climate such as that of the Konkan tract along the sea coast, and also on the western side of the Deccan. Gholvad and Chembur are two of the important centres of cultivation in the Thana District and there is considerable scope for extension of this crop along the sea coast of the Surat, Thana, Colaba, Ratnagiri and Karwar districts. *C. Medica*, and *C. Medica* var. *limonum* can be grown practically in any sub-tropical climate for ordinary purposes and *C. Medica* var. *acida* adapts itself to a great variety of climates. It grows fairly well in the black soil of Puna-Khumbharia near Surat, but prefers well drained soil. The "Santra" and "Mosambi" are not at present grown on a large enough scale, especially in the Deccan and there is plenty of field for the extension of these two crops. The first variety is largely grown in Poona District, and the second enjoys a milder climate such as found actually at Poona. The loose skinned orange varieties are more or less inferior varieties and therefore less profitable.

The propagation by seed of citrus plants except *C. Medica* var. *acida* is not found desirable in this part of the country; seedlings thereby obtained are exceedingly thorny. On the other hand successful results have been obtained with plants budded on var. *limonum*. Propagation by the "*gootie*" (marcotte) method is also practised to a large extent, at the commencement of the rainy season, and the plant is ready for removal in about 4 months. This method is employed both for grapefruit and for limes.

The author describes the manner by which orange trees are induced to flower only once a year (contrary to their natural habit of flowering twice or 3 times in February, June and October), by means of certain efficacious cultural methods.

An analysis is appended showing the percentage content of the various types of soil in this locality. An analysis of 4 waters unfit for irrigation of citrus trees is also given and it is evident from this that water containing respectively (Parts per 100,000) :— total salts 184.00, 224.00, 360.00 and 464.00; calcium carbonate 8.00, 10.00, 20.00, and 22.80; magnesium carbonate 12.17, 15.22, 36.53 and 51.59; sodium carbonate 6.24, 6.24, 10.40 and 12.48; sodium bicarbonate 11.63, 16.05 and 23.50; sodium sulphate 19.52, 20.74, 21.96 and 51.24; sodium chloride 99.33, 136.29, 231.00 and 302.94; is included in this category. On the other hand a water sample containing total salts 80.00; calcium carbonate 12.00; magnesium carbonate 6.09; sodium bicarbonate 19.55; sodium sulphate 4.88; sodium chloride 32.34 was found to be quite fit for irrigation.

Notes and control methods employed concerning the insects pests prevalent in the Bombay Presidency are given. The said pests include *Papilio demolens*, *Nyctipao hieroglyphica*, *Arbeta tetraonis*, *Aspidiotus aurantii*, *Aleurodes eugeniae*, var. *aurantii*, aphides and termites.

[1011]

WITTLE considers that the most suitable places in South India for citrus culture would be parts of the Nilgiris, Shevoroys, Kunnamalais, etc. and in fact, almost anywhere where there is good soil, ample rainfall (average 60 to 120 inches), or where irrigation is available. He surveys the present situation generally and the methods advisable to adopt to increase the produce from the commercial standpoint.

VIII. — CYPRUS. — Although Cyprus is well suited for the cultivation of citrus fruits, their culture is centred mainly in 3 localities: Famagusta, for early oranges and mandarines; Lefka, for late oranges, and Lapithos and Karavas for lemons. The first possesses a sandy soil on a subsoil of ferruginous clay, the second a mixture of sand, chalk and ferrous and copper oxides, the third and fourth mixed sand, chalk or stones. The varieties commonly grown are: *C. vulgaris* (= *C. bigardia*), "Seville" orange, *C. Aurantium* (var. *dulcissimum* (= *praecox*) vars. *aperrimum*, *melitense* (= *sanguineum*) and *oblongum* (Jaffa orange), *C. limonum* (vars. *limetta*, *cedrum*, *pucillum* and *apyremum* (= *aspermum*). *C. limetta vulgaris*, *C. nobilis* (= *deliciosa*), *C. pergamia vulgaris*, *C. medica maxima*, *C. decumana* (= pompelmos).

Sowing the seeds of *C. vulgaris* has been found satisfactory, as on the stock thus obtained, can be grafted any variety that may be desired. This stock is fairly resistant to gummosis, collar and footrot, but grows more slowly than if propagated from layers and cuttings, and although not usually such heavy bearers, the plants have been found to be healthier and live longer. Growers in Cyprus frequently use, however *C. limetta vulgaris* as stock, grown from layers or cuttings from the same species but the fruit thereby obtained, although larger and finer in appearance, has an insipid flavour.

Planting too close together (8 ft. apart instead of the advisable 15 to 25 ft) and irrigation too freely, are the two cultural operations which need rectification if a higher yield is to be espected in Cyprus.

1012 - **Vines of Trentino and the Upper Adige** (1): **Vernaccia, Lagrein, etc..** — I. DALMASSO, G., in *L'Italia Agricola*, Year 58, No. 6, p. 176, 1 plate; No. 7, pp. 204-205, — Plate. Piacenza, May 15, June 15, and July 15, 1921. — II ZANOTTI, L., in the *Bollettino del Consiglio provinciale di Agricoltura*, Year XXXIV, No. 13, pp. 262-263. Trent, July 15, 1921.

I — VERNACCIA. — This is a name given in many parts of Italy to different vines; thus the Trentino Vernaccia has nothing in common with its namesake, the variety that produces the famous dessert wine of Sardinia. In the upper Adige it is known as "Weisservernatsch," but is in no way related to the Schiave and Schiavone types, which are also called "Vernatsch" in German.

AREA OF CULTIVATION. — Vernaccia is much grown in Adige Valley, especially in the vineyards situated on the level ground.

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(1) For information on the Teroldigo, Negrara, Rossara, and Nosiola vines see *R.*, Mar. 1921, No. 302, and *R.*, July 1921, No. 728. (*Ed.*)

AMPELOGRAPHIC DESCRIPTION. — Shoots of average size, not very long, internodes somewhat short, colour, light cinnamon, striped; nodes little prominent; eyes large.

Buds smooth, sometimes reddish. Buds late.

Leaves of average size, trilobed, little serrated, tough; lamina with irregular surface, and somewhat vesicular; upper surface dark-green, lower surface light-coloured, downy; lateral sinuses slightly defined, petiolar sinus open; dentation irregular, teeth rounded; veins pale-green, well-defined. In autumn the edges of the leaves turn red, with a few rust-coloured patches.

Petiole short, strong, slightly tinged with pink.

Bunch of average size cylindrical-conical, very compact, often bearing a small lateral bunch; peduncle average, woody on leaving the node; pedicels green, short, warty; graft-callus well-developed.

Grape average, round, or often ovoid, owing to pressure, yellowish-green in colour (later even yellow), with much bloom, skin very hard, tough, pulp very mucilaginous; simple, not strong, flavour. Pips 3 in number (more rarely 2 or 4), large, slightly tinged with violet.

Ripens at the late second period.

Practical information on the vine. — Vernaccia is a strong-growing vine especially suited to vineyards on level ground with rather damp, deep, rich soil (Riparia soil), and to damp districts for it is resistant to oidium, mildew and rot. On the other hand, it suffers much from excessive heat and drought. It buds late, and is little affected by the white frosts of the spring. It should be pruned long.

The crop of grapes is very large at the Institute of S. Michele, and the average yield for 30 years has been 112 hectolitres per hectare, with a maximum of 158 hectolitres.

This vine usually grafts well, and does excellently on Riparia.

Practical information on the wine. — This is an ordinary table wine, which is much drunk, the must is moderately sweet and, unlike that of most of the Trentino wines, has a high acidity. At the Institute of S. Michele, the average sugar content of the must for 30 years was 16.3 % and the total acidity 10.5 per 1000. When the wine is grown in suitable places, it may contain as much as 20 % sugar, and only 8 to 9 per 1000 of acidity.

Vernaccia is either drunk as a white wine, or mixed with red wines; sometimes it is re-fermented on red grape pomace.

LAGREIN is one of the most characteristic and highly prized vines of the Upper Adige. There are two varieties one with long, and the other with short pedicels.

Area of cultivation. — This vine is grown more or less throughout the Upper Adige region, and especially in the Botzen-Gries district, but its country of origin is not known.

Ampelographic description. — Shoots of average diameter, long, dark-brown, much striped and spotted, internodes of average length, nodes large.

Buds very downy, whitish, pendent. Shoots early.

Leaves average, or below the average, rounded, three or five-lobed, but little serrated, thick, wrinkled, upper surface very dark green, lower surface yellowish green, downy; leaves show very brilliant red patches at the vintage time. Sinus usually shallow; petiolar sinus generally closed. Dentation consisting of sharp irregular teeth, the terminal tooth often very long. Veins much raised. Petiole rather long, reddish. Leaf-fall average.

Bunches of average size, pyramidal, often winged, somewhat branched with long green thinnish stalk, pedicel bright red. Graft-callus of same colour, warty; brush highly coloured.

Grapes rather irregular, usually round, generally longer than the berries of Teroldigo; of average size, violet-black, much bloom; skin somewhat thin but strong; contains much pigment and tannin; pulp very succulent; pleasant flavour, sweet, and clean. Pips 3 in number (rarely 2 or 4) of average size and much pointed. Ripens at first period.

Practical information on the vine. — The Lagrein variety requires good, mellow soil and a mild climate. Long pruning suits it best, although the basal shoots, also bear fruit. At the Institute of S. Michele it has given for 30 years an average crop of 50 hectolitres per hectare, with a maximum of 157; with a better exposure, it might bear a much heavier crop.

It is somewhat susceptible to oidium, anthracnose, and *Tetranychus*. It is well suited for grafting on the chief American stocks.

Practical information on the wine. — With good exposure above Botzen, the Lagrein vine furnishes a wine with a high alcohol content (from 11.5-12 degrees as a rule; but sometimes even 13 degrees andover); acidity moderate, sometimes slight (from 4.6 to 6.5). It has much body is highly-coloured and well suited for blending with light white or red wines like Vernaccia and Rossara; the blend has a pleasant flavour. In wine-making, the grapes of the three varieties are often mixed.

Lagrein Kretzer is a peculiar type of wine obtained by fermenting the must together with the skins for a short time (1-3 days). The resulting wine is slightly coloured, often a little sweet, and has a special characteristic flavour. It is mostly consumed locally.

II. — The vines chiefly grown in the Trentino, such as Rossara, the Paduan Marzemino, Vernaccia, etc., produce a large crop of grapes, but the wines made are only common table kinds, and in order to tide over the present crisis due to a superabundance of wine, preference should be given to vines bearing grapes suitable for choice table bottling wines, e. g., Traminer and Sylvaner, which have been successfully grown for some years in the Trentino, but on too small a scale. The author advises the use of these varieties for new vineyards.

The Provincial Council of Agriculture, the Agricultural Institute of S. Michele and the Agricultural Consortia, have agreed together to try and popularise these choice varieties. All the vines they distribute to agriculturists, whether grafted on American stocks, or growing on their own roots belong to such varieties.

[1612]

1013 - **The Cabernet Vines in Italy.** — SANNINO, L. A, in the *Rivista di Ampelografia*, Vol. II, No. 2, pp. 17-20, Alba-Livorno, February 1, 1921.

The Cabernet group consists essentially of two vines, Cabernet Franc, and Cabernet Sauvignon, to which should be added Cabernelle, or Carmenere. The two kinds of Cabernet are widely cultivated in the neighbourhood of Bordeaux, and especially around Médoc (France).

These vines have also been introduced into Italy, and have done very well where the soil and climate are suitable. The author considers that they should be used more extensively for new vineyards, but does not recommend " Cabernelle," which gives a lower yield. The Cabernets do best in friable soil with a basis of quartz sand. In Italy, the most satisfactory results have been obtained by Count CORINALDI who, shortly after 1870 planted a large vineyard at Lispida with these two Bordeaux varieties in the volcanic zone of the Euganean Hills. On the limestone zone of these hills, the wine made from the grapes of the same vines is very different and not only contains more alcohol, but is more higly coloured ; it lacks the bouquet and delicate flavour of the Lispida product.

The Cabernet vineyards that were planted later on the plain of Treviso, did not give satisfactory results, either because the grapes dropped, or were of inferior flavour, because the vineyards were situated too low, and on damp soil. Much better crops were obtained in vineyards planted later on the hilly land, on "ferretto," i. e., red sandy clay soil rich in iron and free from lime, such as is found at Montello and the hills of Susegana and Conegliano, and extends as far as Vittorio-Veneto. The author thinks that the hills of Pignerola and the surrounding district, where the soil is a sandy clay poor in lime, would suit the Cabernet vines very well but that the friable soils on the left of the Tanaro are particularly adapted to this variety.

Prof. CARLUCCI grew some of these vines in 1882 at Avellino, where they flourished, for as they shoot late, they escape the early frosts and ripen at a favourable time (second period). The grapes are rich in sugar, contain but little acid, have highly coloured skins, high tannin content, and resist rot. Near Rome, in the Balestra vineyards, Cabernets have been grown with great success, the wine made from their grapes being exceptionally choice.

1014 - **Improving the Bicane Vine by Crossing in Italy.** — PIROVANO, A., in the *Rivista di Ampelografia*, Year II, No. 6, pp. 81-86. Alba-Livorno, June 1, 1921.

The Bicane vine, when growing on its own roots, is a very fine table variety with unusually large, loose bunches of big, golden fruit. Where, however, the spread of phylloxera has necessitated its being grafted on American stocks, it has quickly degenerated. The vine has not lost its vigour (therefore the poor crop cannot be attributed to want of grafting affinity), but the grapes it bears, are small, aborted berries without pips and split with the first autumn rains. As these defects show themselves every year they cannot be due to accidental climatic conditions.

Artificial fertilisation with the pollen of very strong vines (Ganzin No. 1, or Rupestris du Lot whether grafted stocks, or direct bearers) results in the production of very fine bunches, if the operation is performed on a Bicane vine growing on its own roots, but is an utter failure (as the author found) if the Bicane is grafted on an American stock. The same holds good in the case of other vines : Schiraz, or Pépin de Schiraz, Caprizzisa or Bizzarria and, etc.

Examination ot the flower of a grafted Bicane reveals no abnormality, it is possible that the abortion is produced by the hypertension of the stigma and the ovule caused by an excessive flow of sap from the American stock.

The author has tried to remedy this trouble by obtaining Bicane hybrids. In the present article he describes the selected products of 3 crosses effected with Muscat de Mandresfield, Poeta Matabon and Pergolese (Almeira), respectively. This method was completely successful.

Four vines with white grapes from the progeny of the cross Bicane × Muscat de Mandresfield — IP (Pirovano cross) 53 — 1P54 — IP64 — IP65 —, and 3 with red grapes : IP52 — IP55 — IP56, were selected, and also 1 hybrid with white grapes obtained from the cross Bicane × Poeta Matabon, IP59, and 2 with red grapes, IP57 and 1P58. Only 1 hybrid (bearing white grapes) from the cross Bicane × Pergolese of these vines, which all produce a large number of very fine bunches, was selected. The author gises a description large berries; they all have, however, the defect that the grapes do not keep well.

1015 - An Experiment with a view to Seasoning Standing Timber and to Obtain an Efficient Means of Exterminating Forest Weeds in Trinidad. — Moor, H. W. (Deputy Conservator of Forests). in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol XIX, Pt. 2, pp. 89-90. Port-of-Spain, 1921.

The lack of seasoned local timber in Trinidad and the difficulty, on account of the high cost of labour and transport, of seasoning it without appreciably raising the already high initial cost of production, led the Forest Department to consider the question of artificially killing trees and seasoning them standing. The accepted method of girdling ("barking") the tree is not successful for all species and is particularly unsuitable in a tropical country on account of the large number of insects always ready to destroy any dead or partially dead vegetation.

An experiment was made in June 1918 with 54 trees of miscellaneous species in the Southern Watershed Reserve with a view to: —

1) Killing trees and seasoning them standing without exposing them to insect damage;

2) Killing forest weeds without the initial cost of cutting and the ever recurring cost of removing fresh growth from the stools.

The treatment consisted of cutting out a ring about 9 in. in width, of bark only, and painting on the undiluted preservative ("Atlas Preservative") (1) with a brush, (in the case of palms a ring about 1 inch deep was cut). At the end of the following July, 19 trees were dead, at the end of August a further 27 were dead and by the end of October all but 5 trees were dead and even these had lost all their leaves and their bark was dry.

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(1) Particulars of the Atlas Preservative may be obtained from the Chipman Chemical Engineering Company, Liberty St. New York, N. Y. (*Ed.*)

[1014-1015]

Amongst the species most susceptible to the poison were Mahoe (*Hibiscus elatus* Sw.). Gommier (*Bursera gummifera* L.), Bois Cannon (*Cecropia peltata* L.), Redwood (*Sequoia sempervirens*), Angelin (*Andira Aubletii* Benth.), Cooper-hoop (*Alphitonia excelsa*), etc. and those most resistant were Milkwood (*Alstonia schloraris*) and Hog Plum (*Prunus hortulana*), etc.

This and subsequent experiments made on several other species, as well as on several kinds of vines, have given distinct evidence that " Atlas Preservative " when applied to even a narrow ring of the growing tissue, circulates with the sap and not only kills all species of vegetation, but kills the root as well as the portion above ground, and is an ideal means of removing undesirable weeds. The preparation is effective whether applied in the growing season or in the season of rest.

As regards seasoning standing timber, large soft wooded trees were readily attacked by insects, but, on the other hand, mature hard wooded trees, though normally attacked when felled green or killed by simple girdling, when treated in the manner described above, are only attacked in the sapwood, the heartwood being left untouched.

Results have so far demonstrated :— 1) That mature trees of species normally fairly resistant to insect attacks can be made immune, and the wood may be seasoned standing in about 3 years: 2) Atlas preservative effectively kills all trees and plants to which it is applied, and does not touch the surrounding trees, confining its effect solely to the individual tree to which it was applied. One gallon of preservative is sufficient to kill about 80 trees, averaging 2 ½ ft., in girth, and 2 men can poison 100 trees (if near together) in 1 day.

The author states that although Atlas Preservative was employed throughout the experiments here described, there is no reason to believe that any other preparation of a similar nature may not prove as successful.

1016 - **Utilisation of Sycamore Wood for Industrial Purposes in the United States.** — BRUSH, W. D., in *United States Department of Agriculture, Bulletin* No 884, pp. 1-24. Tables 8, figs 3, pl. 4. Washington, D. C., Oct. 12 1920.

The principal supply of sycamore is from that part of the central hardwood region which includes West Virginia and Missouri, and the intervening States, and also Arkansas and Tennessee, and the principal centre of the sycamore industry seems to be at present located near the junction of the Ohio and Mississipi Rivers. The actual output of sycamore lumber, by States in 1899 and 1904 and from 1907 to 1918 inclusive is given and also the average value of the product as reported from the mills. There is considerable fluctuation in the amounts of lumber produced by the same state in successive years, but the author attributes this to the difficulties in transportation of logs and the irregularity in supply, since the timber, being confined so largely to river bottoms, is logged also in a somewhat irregular manner.

Only a negligible quantity of sycamore is used in the rough for such purposes as building contruction, etc. It goes principally, therefore, to factories for the manufacture of various products such as boxes and crates, slack cooperage, furniture and fixtures, sashes, doors, blinds, butchers' blocks, musical instruments, agricultural implements, carpet sweepers, trunks, sewing machines, brushes, vehicles, ship and boat building, saddles and harness, sporting and athletic goods, frames and moulding, etc.

The largest amount of sycamore goes into the box and crate industry and is of special value for use in certain containers, such as slack barrels and plug-tobacco boxes. It ranks low, however, in amount consumed (25 native woods, including 13 hardwoods, are used in larger quantities).

The author describes in detail the general appearance, properties and structure of the wood, and gives the average properties of sycamore wood as compared with white oak as follows (Oak = 100) Per cent. specific gravity 76.7;, shrinkage (*a*) volume 99.3; (*b*) radial 104.1; (*c*) tangential 84.4; strength in bending 75.2; strength in compression parallel to grain 82.7; strength in compression perpendicular to grain 61.9; stiffness 80.9; hardness 58.2; shock resisting ability 56.4; shearing strength parallel to grain 76.6

The average computed weight (in pounds) of sycamore in different forms is given. The standard weight of the National Hardwood Lumber Association for rough sycamore lumber 1 inch thick is 3000 lb. per 1000 board feet and for green sycamore lumber 1 inch 4750 lb. per 1000 ft.

The author also gives details of the limber and timber values, grading rules, etc. The plates include a photomicrograph of a transverse section of sycamore wood.

LIVE STOCK AND BREEDING

1017 - **Cattle Poisoned by Horsetails *(Equisetum palustre)*.** — Hoc, P., in the *Journal d'Agriculture pratique*, Year 85, No. 29, pp. 77-79. Paris, June 23, 1921.

Although the horsetail (*Equisetum palustre*) is not regarded as a noxious plant, it is nevertheless poisonous to most animals. The author mentions some cases of poisoning in cattle, in the Department of Aisne, which were studied by M. Rohr, Army veterinary-surgeon, in conjunction with the veterinary surgeon treating the animals. The animals had been given per head for 3 weeks, a supplementary ration of 3 kg. of hay, of which over one-third was composed of horsetails. Out of 17 head, 5 died in a few days; the others were sold to the butcher.

The symptoms of poisoning are as follows:— Dejection, the animal not raising its head; difficulty in mastication; cessation of rumination; the eyes become hollow and the sight dim; the pulse and respiration are slow, the temperature falls. The faeces are black, and have a strong odour. The sick beast soon leans its chest against the feeding-trough holding its head vertically, and its nose applied to the bottom.

The next day, the animal is in a state of collapse, the eye sinks further into the socket, and complete loss of sight ensues.

Then follows a period of intense excitement, which might be taken for an actual fit of madness, but usually the animal rests its nose on the bottom of the trough, or on the ground, and pushes against the wall; the circulation quickens, respiration becomes difficult and loud, and asphyxia sets in. Then the affected animal falls down and dies, or sometimes rises once more, until it is carried off by another similar fit.

If the cattle have reached the stage of over excitement, the meat has a febrific aspect, but if they are slaughtered at the beginning of the illness, before they have begun pushing at the wall, the flesh has a good appearance and can be eaten without risk.

Hyposulphite of soda, given before the disease manifested itself, seems to have reduced the number of cattle affected. It acts in the digestive tract as an anti-ferment. When once the illness has declared itself, no treatment is of any avail, as the symptoms immediately become serious.

The degree of the toxicity of horsetails is very variable, depending entirely on the soil upon which they grow, the way in which the fodder is kept, and also upon the susceptibility of the animals, susceptibility being greatest when the cattle are young.

This explains why, in some cases, these plants have been eaten by stock with impunity. Equisetaceae are less dangerous when mixed with other foods, when they have been stacked for over 6 months or have been well washed by rain.

The toxic effect is due to an alkaloid, or some other vegetable poison, present in the horsetails. A subcutaneous injection made with 20 cc. of an infusion of the suspected hay, which had been concentrated at a low temperature to a tenth of its original volume, will produce all the symptoms of acute poisoning in a guinea-pig or rabbit.

1018 - **Preparation of Arsenical Solution for the Destruction of Ticks.** — COPEZ DOMINGUEZ, F. A. (Jefe División de Química), in the *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo, Estación Experimental Insular, Río Piedras, P. R, Circular n.* 24 pp. 11. San Juan, P R, May 1920.

Advice intended for stock-breeders on the preparation of the arsenical solution used for destroying cattle ticks. The formulae are based on the results of studies made in the Chemical Department of the Porto-Rico Agricultural Experiment Station.

The method of preparation recommended is as follows:— 1) Heat the water to the boiling-point; 2) Stir in the soda until it dissolves; 3) add the arsenious acid, stirring all the time, and taking care that the water does not go off the boil; it takes at least 35 minute before the acid is completely dissolved; 4) pour the solution into a barrel, and let it cool to 60° C. that is to say, until a person can hold his hand for some seconds to the outside of the barrel; 5) when the mixture has cooled down to this extent, pour some tar into the barrel, stirring all the while; when all the tar is added, stir for 5 minutes, then add it (being careful to mix it well) to the water already in the tank in the proportion of 5 hectolitres per hectolitre of concentrated solution. Each 100 litres of the solution should contain 12.5 kg. soda, 4.2 kg. arsenious acid, and 4.5 litres of tar.

The solution in the tank in which the animals are washed must be analysed once a month, to ensure that it is not too dilute.

1019 - **Studies and Researches on Epizootic Foot-and-Mouth Disease in Italy and Switzerland** (1). — I. BARTOLUCCI A , in the *Giornale di Agricoltura della Domenica*, Year XXXI, No 20, p. 158. Piacenza, May 15, 1921. — II. *Il nuovo Ercolani, Rivista di Medicina veterinaria*, Year XXVI, Nos. 9-10, pp. 179-182. Turin, May 15-31, 1921. — III. LUDWIG, Traitement de la fièvre aphteuse par le sang d'animaux guéris, in *Schweizer Archiv*, p. 285, reprinted in *Annales de Médecine vétérinaire*, Year 66, No. 5, pp. 210-212. Ixelles-Brussels, May 1921.

I. — Since 1916, on the initiative of the Director General of Public Health in Italy, an expert Commission presided over by Prof. di VESTEA of the University of Pisa, has been experimenting with a view to discovering the means of rendering cattle immune to foot-and mouth disease (aphthic fever). During the same time, the commission has extended its researches to the etiology, pathogenesis, clinical form, epidemiology, etc., of the malady. Early in February 1921, the commission declared its task accomplished, and presented to the Director General of Public Health its final report and the special reports of the different investigators from which the following information has been taken.

Except for the results obtained, thanks to the efforts of M. LÖFFLER on the subject of passive protection due to the use of the serum of immunised animals, which could not be applied on a large scale, for economic reasons, all experiments undertaken for the purpose of finding a practical method of active vaccination have been entirely fruitless.

Therefore, the first place has always been occupied by inoculation with natural, benign virus carried out according to the classical grafting method, commonly known as " aphthisation ", consisting in rubbing on the mucous membrane of the mouth some virus taken from animals affected by a benign form of the disease, in order to communicate the benign form of the malady to all cattle exposed to contagion, or to shorten the course of the epizootic by conferring a more or less lasting immunity upon animals that had already undergone the previous treatment.

This was the state of affairs in 1913, when Prof. TERNI, of the Experiment Station for the Study of Infectious Diseases, at Milan, announced that he had succeeded in making cattle immune to foot-and-mouth disease by a method of his own (systematic aphthisation), which consists in strengthening the immunity conferred by a natural attack of the disease, by means of intravenous or subcutaneous injections of natural virus administered from a very early age, successively and periodically. These injections give a thermic reaction unaccompanied by clinical symptoms, or any fear of the animals treated spreading infection ; this virus apparently is so attenuated when it enter the organism as to be no longer dangerous.

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(1) For other studies on epizootic foot-and-mouth disease (epizootic aphthic fever) see *R.*, 1911, Nos. 890, 2197, 2783 ; *R.*, 1913, No. 954; *R.*, 1914, No. 644 ; *R.*, 1916, Nos. 661 and 768 ; *R* , 1919, No. 923 ; *R.*, 1920, Nos. 335 and 882 ; *R.*, 1921, Mar. No. 309 July, Nos. 734 and 735 ; Aug. No. 829. (*Ed.*)

The Director General of Public Health was anxious that this method should be tested practically on a large scale. For this reason, the technical commission was entrusted with the supervision of these experiments.

Experiment centres were rapidly organised in the different regions of Italy, animals of various breeds, ages and performance were inoculated, and the Commission was able to arrive at the following general conclusions on the efficacy of the TERNI method:—

1) The regular consequence of a natural attack of foot-and-mouth disease is to induce a resistance to the virus that lasts for months or even years, but there have been cases of a second on third attack, the disease even assuming a severe form.

2) The immune condition resulting from the first attack can be prolonged by successive inoculations of the virus at different intervals, so that most of the animals can be protected for many years from the usual form of the disease prevalent in the district. In the case of malignant foot-and-mouth disease, however, practical experiments have proved this protective measure to be far less efficacious.

The Commission started its labours by supervising practical, large-scale experiments with the aphthisation method suggested by Prof. TERNI. But in the course of their work, they extended its scope to a group of other collateral researches which in turn became of the greatest importance in relation to immunisation against foot-and-mouth disease, and to fresh scientific knowledge of the disease.

Dr. COSCO and Dr. AGUZZI, who have carried out much original research work at the Experiment Station instituted for this purpose at the " Regia Cascina " of Poggio at Caiano (*frazione* of Carmignano, Province of Florence) have amongst other things, discovered hitherto completely unknown facts connected with the virulence of the red blood corpuscles of cattle suffering from foot-and-mouth disease. The properties of these corpuscles render it possible to adopt a method of active vaccination more in accordance with the scientific principle of obtaining immunity, by the use of an easily injected virus of constant toxic properties.

To begin with, the investigators demonstrated for the first time the possibility of fixing a virus of constant virulence in washed red blood corpuscles, whereas the hopelessness of attaining this object had been regarded as a fundamental hindrance to all experimental work based on vaccination.

It was then found that an intravenous injection of virulent, washed, red corpuscles, 2 ½ times as strong as an effective subcutaneous injection, could be given without inducing the disease. The intravenous introduction of these corpuscles in certain doses produces a strong thermic and organic reaction in cattle, without causing the development of aphthic lesions, but after a period (negative phase), which appears to exceed 15 days, the animals are endowed with greater powers of resistance to natural contagion.

The experiments that could be brought to a conclusion proved that with active virus and several inoculations, absolute immunity can be conferred for 3 months, as was shown by the tests.

Other experiments made by the same workers with attenuated or dead virus, and also by Prof. TERNI with dead (autolysed) virus confirmed the statement that if dead vaccines produce greater resistance in cattle, they do not give any immunity of practical value.

After examining the results of these prophylactic experiments, the Commission proceeded to examine and test other researches on the pathogenesis and etiology of foot-and-mouth disease.

Dr. AGUZZI is said to have demonstrated that special corpuscular bodies appear inside the red blood corpuscles during a single phase of the attack of aphthic fever (a phase corresponding to that of the virulence of the corpuscles themselves).

These special bodies, which are visible when examined in a dark microscopic field, are quite distinct from the remains of the nucleus or the nucleolus. He is stated also to have pointed out granular bodies in the blood serum, and in the lymph of the aphthic lesions, which are visible in the dark field of the microscope during each phase of the febrile stage of the malady. This discovery may perhaps throw some light on the etiology of foot-and-mouth disease.

II. — The results of the large-scale application (due to Prof. TERNI), of hyperimmunised blood-serum added a new chapter to anti-aphthic haemotherapeutics and haemoprophylaxis. Recently the Swiss Government has made full use of the prophylactic and therapeutic properties of the blood of animals that have recovered, or have been hyperimmunised; and has instituted and encouraged the establishment of centres for the preparation of this means of protection by methods similar to those adopted in Italy.

III. — As the disease assumed such a malignant form during the last outbreak in Switzerland that 60 % of the animals attacked died, LUDWIG tried various measures, hoping to ward it off or at least attenuate its virulence. He used " superol ", a preparation with a quinine basis, and " aptocura ", an Argentine specific which was advertised to cure foot-and-mouth disease in less than 3 days, but the results obtained were absolutely *nil.*

LÖFFLER'S researches encouraged the author to begin experiments in serotherapeutics. There is no doubt that the blood of animals which have recently recovered from foot-and-mouth disease contains anti-bodies that protect the individual from a fresh attack of this fever; the difficulty consists in the practical use of these antibodies. The author first tried to obtain a serum by centrifuging the blood, but was soon convinced that this method was impractical, and he abandoned it in favour of de-fibrinising the blood. The results of his first experiment with fibrin-free blood were successful, although the quantity of blood used was too small and the animals had been ill for 2 to 3 days. On the first day, the cattle were given a subcutaneous injection of 200 gm., the amount being increased to

300 gm. on the second day. The patients showed no symptoms of disease at the time of injection.

The author always tried to obtain blood from at least 5 animals, and to mix it as completely as possible. As the animals had been cured for about 15 days, nearly 4 weeks had elapsed since the development of the malady. LUDWIG did not take blood from animals that had recovered at an earlier date, because the immunity conferred by foot-and-mouth disease is of relatively short duration. He found no difference in the value of the blood of different individuals; unfortunately there is no means of ascertaining this value and a preliminary test blood cannot be made, as the blood must be used as fresh as possible. So far, no means have been devised for determining how long the blood retains its activity.

It has not yet been ascertained if the blood of animals, that have been vaccinated and have only contracted the disease in a very mild form, can be used with any chance of success. The author employed intravenous injections with a view to rapidly, and thoroughly mixing the blood thus introduced with that of the animal under treatment; young or susceptible individuals were given subcutaneous injections only. He found no difference between the results of the two methods. The average amount to be injected is 500 gm., viz., 600 for cows, 500 and 400 for heifers and calves, respectively. As an experiment, the author injected 2 litres into the vein of an animal without its suffering any ill effects. Further experiments have been made to ascertain the minimum effective dose. Of over 600 animals treated in 50 centres of infection, $1/3$ were ill, and the remaining $^2/_3$ still healthy at the time of vaccination.

In each cow-shed, he kept some control animals, most of which became seriously ill, and some even died.

The results of the experiments may be summarised as follows:—

a) *Treatment of healthy animals.* — After injecting from 600 to 800 gm., of infected blood, most of the animals, provided they were free from fever at the time, gave no apparent signs of having contracted the disease. The disease generally broke out after the injection of 400 to 500 gm., but in a much less severe form than that from which the control cattle were suffering.

It is an interesting fact that the milk production of vaccinated cows hardly diminished; a temporary decrease of more than a half was a rare exception. The course of the disease in vaccinated animals is more rapid and their general condition is less altered.

b) *Treatment of sick animals.* — Cattle which have contracted the fever seem to be less affected by treatment: if large doses are given, however, recovery is hastened. The author mentions several experiments of which the following are the most characteristic:— In one shed 17 cows were vaccinated, and 11 kept as controls. The 17 vaccinated cattle (6 heifers and 11 cows) were not yet ill. Of the 11 cows, 2 contracted the disease in a benign form, and the others remained in perfect health; the decrease in milk production was generally negligible. Of the control animals, 1 cow died of cardiac paralysis, and 2 had to be killed because their hoofs fell off; of the rest one alone gave as much milk as previously; the milk production of the others falling below half. Most of the control animals suffered from serious lesions in their feet.

The author affirms that the injection is harmless if the animals providing the blood are carefully chosen, if all the appliances are scrupulously clean and if the blood is fresh.

The stronger the dose given, the more certain is the effect; 100 to 200 gm. is too little for heifers and cows.

1020 - **Purulent Epizootic Epididymitis in Rams in Former German South West Africa.** — SCHEBEN L., in the *Berliner Tierärztliche Wochenschrift*, Year XXXVII, No. 15, pp. 172-173. Berlin, April 1921.

Observations made on a flock of 100 sheep of the fat-tailed variety bought in March, 1913, for a sheep-farm in German South West Africa.

As castration had not been carried out for some years, a beginning was made at the end of March by castrating all the 7 year-old rams. In 54 animals, unilateral purulent epididymitis (usually on the left side) was observed, and there was even one case which was bilateral.

In May and September, when other animals of the flock were castrated, the same typical form of epiditymitis made its appearance in the rams of all ages.

Symptomatology and diagnosis. — There was no sign of the disease before castration, nevertheless the *intra vitam* diagnosis is easy, and can be effected either by palpation, or by mere examination in advanced cases, as the affected organ is then much swollen. The diseased animals gave evidence of more or less pain, when slight pressure was applied to the distal end of the scrotum. The scrotum itself moves easily over the infected organ, and is free from wounds or scars.

On the other hand, there is an abundant flow of phlegmonous pus from the orifice of the sheath.

In both cases, suppuration of the testes resulting in their complete detachment accompanied the epididymitis.

The *cauda epididymis* was always the part most affected, but in the *vasa deferentia*, large swellings often occurred. A vertical section of the epididymis revealed the presence in the *cauda* of 1 to 5 pyogenic pockets of different sizes containing a white, yellowish, yellow, or greenish substance the consistence of cream, or pulp, which was usually free from odour, but in some cases gave off a nauseating smell. Except in the two above-mentioned cases the abscesses were localised in the distal part of the epididymis, whereas the proximalp ortion was more or less swollen, moist, or congested, according to the intesity of the suppurating process. Except in 2 cases, all the operation wounds closed without subsequent treatment.

The correctness of the author's idea that epididymitis is a specific affection of the genital organs of an infectious character was borne out by the subsequent appearance of the disease in the flocks of sheep and herds of goats on a farm in the same region, the animals having been infected by those of a neighbouring homestead.

The author states that this disease, which seems to be very widespread, has not yet been mentioned in veterinary literature.

1021 – **Intrajugular Inoculation of Rabies Virus into the Sheep and Dog.** — REMLINGER (Directeur de l'Institut Pasteur du Maroc), in the *Recueil de Médecine Vétérinaire* Vol. XCVII, Nos. 8-10, pp. 172-175. Paris, April-May 1921.

According to the received opinion, the inoculation of rabies virus gives very different results with herbivora from those than with other animals. Injection of this virus is said to induce rabies in the former, but to have no such effect upon the latter, even rendering them immune to the disease. In 4 series of experiments on sheep and dogs, the author found, that adult sheep and dogs reacted in precisely the same manner to an intrajugular injection of rabies virus. In fact, the percentage of the sheep and dogs that died of hydrophobia was respectively 31 and 38 %.

1022 – ***Euparyphium suinum*, a New Echinostoma from the Intestine of the Pig.** — CIUREA, J, in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 19, pp 1000-1013, 1 fig. Paris, May 28, 1921.

Of the Echinostomidae only *Echinochasmus perfoliatus* var. Ratz has as yet been recorded as a parasitic of the pig.

In the contents of the intestine of a young pig that had been given 40 tench and 8 bream in 55 days, the author found a new species of echinostomate which he has described under the name of *Euparyphum suinum* . It is probable that the pig became infected by this parasite through eating the above-mentioned fish.

1023 – **The Presence in the Saliva of Healthy Animals of a Virus Producing Kerato-Conjunctivitis and Encephalitis in Rabbits.** — LEVADITI, C., HARVIER, P., and NICOLAU, S., (Institut Pasteur de Paris et Laboratoire de Medecine expérimentale de la Faculte de Médecine de Culj, Roumanie), in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 16, pp. 817-818. Paris, May 7, 1921.

A short pathogenetic description of these affections induced by inoculating into the cornea of a rabbit, some fresh saliva taken from perfectly healthy animals that had never suffered from encephalitis. Certain normal salivas only produce kerato-conjunctivitis, but in 1 case the saliva injected into the cornea also gave rise to keratitis. The animal died on the 8th day, manifesting symptoms of encephalitis. The authors promise to furnish new data.

1024 – **A New Enzootic Disease of Fowls Caused by the Trematode *Prothogonimus intercalandus*, in Germany.** — HIERONYMI, E. (Director of the Veterinary Institute of the University of Koenigsberg) and SLIDAT, L., in the *Centralblatt fur Bacteriologie, Parasitenkunde und Infektionskrankheiten*, First Part, *Medizinisch-hygienische Bacteriologie und Parasitenkunde*, Vol. LXXXVI, Part 3, pp. 236-241. Jena, May, 1921.

In flocks of fowls, serious laying troubles have been observed ending in the death of all the affected birds (1). Death was due to vaginitis and secondary peritonitis caused by a parasite mentioned in the literature and belonging to the genus *Prothogonimus* Lühe. The new species, studied and described by SZIDAT, occupies a position intermediate between *Prothogonimus pellucidas* Linstow, ans *Prothogonimus japonicus* Braun.

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(1) The disease has been observed in the neighbourhood of Koenigsberg in Prussia, where 12 fowls succumbed out of a flock of 14. The birds were kept on a common where there was a pond from which they used to drink and pick up the small animals on the bank.

Symptoms. — The clinical symptoms that could be observed during the course of the malady were not very characteristic at first. The birds became restless, crouched here and there in a moping condition, with their plumage ruffled, and finally lost their appetite. In all cases, the laying fowls were seriously affected. At first, they laid eggs with remarkable thin shells; subsequently the calcareous portion was entirely lacking, and the eggs had a soft covering. Very soon the hens ceased laying and died after a few days.

Pathological anatomy. — This chiefly consisted in affections of the vagina and peritoneum which are minutely described by HIERONYMI. The other organs showed no particular morbid symptoms. Bacteriological examination failed to reveal the presence of specific micro-organismos.

Treatment and prophylaxis. — No curative treatment of this parasitic disease seemed to be of any use. HIERONYMI advised shutting the fowls, up, and feeding them exclusively on grain. Hens thus treated developed no further symptoms.

In order to prevent the occurrence of the disease, it is suggested that fowls should be kept from drinking at suspected ponds and from eating dragonflies.

1025 - Determination of the Amount of Assimilation Energy Necessary for the Production of Meat and Fat in Young Pigs; Experiments in Germany.

— WELLMANN, O., in the *Deutsche Land-wirtschaftliche Presse*, Year XLVIII, No. 43, pp. 325-326. Berlin, June 1, 1921.

KELLNER has repeatedly recorded the amount of energy expended in transforming the products of digestion into animal tissues; but it was only in 1913, that more specific data were published by HEIDE and KLEIN showing the energy output of the pig (1). Independently of these researches, the authors had determined, by experiments combined with the analysis of young pigs, the work of assimilation required for the production of meat and fat.

As a rule, dynamic changes are determined by respiratory analyses, which have the disadvantage of showing only indirectly the composition of the increase in live weight, and the energy expended in producing it, so that first the one, and then the other, have to be calculated.

The author, by combining his experiments with the analysis of the young pigs and supplementing them by respiratory analyses, has been able

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HIERONYMI draws attention to the fact that at the time of the outbreak of the disease, the number of *Libellula quadrimaculata* was unusually large. During the same season, an enzootic malady with similar symptoms had been recorded in other parts of Prussia.

See THIENEMANN J., Libellenflüge und weichschalige Eier (*Georgine*, 1920, p. 315, (*Author's Note*)

(1) *Biochemische Zeitschrift*, year 1913, Vol. LV.

to determine directly the output of energy and the increase in weight produced. The maintenance energy necessary for the animal was reckoned by the help of experimental data obtained by TANGELS (1), and the quantity of energy used in digestion determined with the assistance of ZUNTZ and MAGNUS-LOWY's calculations (2) which enabled the amount of energy available for production to be estimated.

The composition of the increase in weight, and the energy consumed in producing it, were determined as follows :— The young pigs used for the experiment and the control animals were taken from the same litter. The pigs were killed and examined, and the energy used in the formation of the tissues was calculated. This was done at the beginning of the experiment with the control pigs, and at the end with the others.

The experiments proved that on an average 11.5 calories are needed for the production of 1 gm. of dry organic matter, not including its fat content. Taking into account the heat of combustion of the fat, the author also found, that the worh of assimilating 1 gm. of fat, 1 gm. of protein, and 1 gm. of fresh meat used respectively 2.1, 6, and 1.1 calories.

The author draws attention to the fact that the results of his experiments connected with the work of assimilation are in good agreement with the data given by HEIDE and KLEIN, except as regards the assimilation of protein, for which the figure obtained by the last-named investigators was higher (1 gm = 7.25 calories).

Taking these data as a basis, it may be said that young pigs make better use of the available energy in putting on fat than in the production of flesh, the use-coefficient of the available energy being respectively 82 and 48. The experiments further showed that the part played by the different nutrient elements in the formation of fat is in proportion to their store of productive energy. The work needed for the assimilation of fat is the same, whether the animal fat is formed at the expense of carbohydrates, or obtained from the fat present in the ration.

One gramme of increased weight, when due to the formation of flesh with the normal water contents, represents the combustion heat of 1 calory as against 9.4 calories in the case of 1 gm. of fat. Thus the production of 1 gm. of meat (reckoning the work entailed in assimilation) uses 1.2 calories of energy, whereas 11.5 calories are needed to produce the same amount of fat. The author also states that in his experiments, the energy used in assimilation was entirely supplied by the nitrogen-free nutrient substances, and this process of assimilation in no way increased the decomposition of animal protein. Hence for the production of meat, should a sufficient amount of nitrogen-free substances be available, all that is necessary is to supply the animal with the amount of protein strictly required for this purpose, plus the maintenance ration of protein.

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(1) According to TANGELS' experiments, the minimum amount of energy required to support life at the critical temperature of 20° to 33° C, is 1100 calories per sq. m. of surface.

(2) The work of digestion uses 0.8 calory per 1 gm. of digestible protein, 0.4 calory for 1 gm. digestible carbohydrate, and 0.24 calory for 1 gm. of fat. *(Ed.)*

Although KELLNER's starch values (1) are not directly applicable to meat production, it is however advisable to use them (with the following corrections) in practical work.

To produce 1 kg. of fat a pig requires (in addition to the maintenance ration) 3 kg., and not 4 kg. of starch values, because the work of digestion in pigs is less than in cattle.

In order to produce 1 kg. of meat, a pig requires, in addition to the maintenance ration, 0.2 kg. of digestible protein and 0.5 kg. of starch values. It follows from what has already been said, that the production of meat, because of its water content, and the good use made of food proteins, only requires $^1/_6$ of the starch values needed for the production of fat; this fact should be taken into serious account in rearing young pigs.

When fattening pigs, it should be remembered that the youngest, most rapidly-growing, animals are the most thrifty, for they possess most growth energy and, further, the production cost involved in increasing the meat weight is less than in the case of older pigs, which put on more fat (a process involving a greater expenditure of energy), and produce less meat.

According to the author's experiments, a young Berkshire pig, from 6 to 12 weeks old, can produce per 1000 kg. of live weight, 25 kg. of meat daily, which requires 4.5 kg. (or in round number 5 kg.) of digestible protein.

Supposing, for instance, that young weaned pigs which are growing rapidly, are fed according to KELLNER's method (6.2 kg. of digestible protein and 33.8 kg. of starch values), the probable production will be as follows:—

	Digestible protein kg.	Starch values kg
Absorbed	6.2	33.8
Necessary for maintenance of life	1.0	14.3
Available for production	5.2	19.5
The production of 25 kg. of meat required	5.0	12.5
Available for fat production	—	7.0

There remain over from the production of fat 7.0 kg. starch values that can be transformed into 2.3 kg. of fat. The increase in weight is thus 27.3 kg., as against 6.5 kg. when fat is exclusively produced.

These experiments show clearly enough that the starch values, even when corrected, as suggested by HANSSON NILS, are not applicable to meat production, because not only is the utilisation of the protein 40 % higher as compared with the starch values, but the work of assimilation in meat production must also be taken into account. On the other hand, the production of the protein entering into the composition of the flesh cannot be estimated in the same manner as that the milk protein, which requires a very small amount of assimilation energy.

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(1) See *R.* February 1916, No. 194, and December 1916, No. 1296. (*Ed.*)

1026 - Fresh Forage versus Silage for Dairy Cows under Nebraska (U. S.) Conditions (1).

— FRANDSEN, J. H., HENDRICKSON J. W., WHITE, G C., NORTH, A. C. and WOODWARD, E. G., in *Journal of Dairy Science*, Vol. IV, No. 2, pp. 124-153, tables21, Baltimore, March, 1921.

Nebraska pastures generally furnish insufficient feed for dairy cows during the dry season and it is found necessary to supplement the pastures with either fresh forage or with silage.

If partial fresh forage feed is employed the conditions in Eastern Nebraska are well adapted, as sufficient rainfall is obtained nearly every summer. According to the statistics obtained from the Weather Bureau at Lincoln the average rainfall for the last 40 years amounted to 29.6 inches; 1914, 26.53 in.; 1915, 29 in.

In addition to this, the soil is equally favourable to forage crops as there is a deep layer of Loess soil over the major portion.

The objects of the experiments undertaken lasting over a period of 2 years (1914-15) were: — 1) to determine the most desirable rotation of fresh forage crops with respect to yield, date of sowing, date of harvesting together with an estimate of the cost of production; 2) to determine the value of fresh forage crops as compared with summer silage in the ration for milk production; 3) to ascertain the comparative economy of butter fat produced by cows fed on fresh forage and silage respectively.

Eight cows were selected for feeding and were kept in dry lots (*i. e.* without pasture). Four were fed with fresh forage *ad libitum.* As a supplementary ration, they were fed with a 4 : 2 : 1 mixture of maize, bran and oil meal (obtained by pressure), in amounts considered sufficient to keep them in normal production condition.

The other 4 cows were fed with the same mixture togther with lucerne hay and maize silage, ratio 1 : 1 : 4.

All costs in money values were eliminated from this study and comparisons were made on the basis of total nutrients of the feed or its protein and energy content and on the basis of hours of labour and production.

In the fresh forage group, the following plants were used rye, wheat, lucerne, oats+peas, white sweet clover, maize, sugar cane, millet, kaffir and cow peas (*Vigna senensis*). Details as to the date of sowing, date of harvest, methods of cultivation. rate of sowing, chemical composition and cost of production both for fresh forage crops and for silage are given in various tables. The result of the 2 years under consideration are collected in the appending Table.

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(1) See *R.* May 1916, No. 537; *R.* April 1917, No. 348. (*Ed.*)

Fresh forage versus silage in the summer feeding for dairy cows.

		Averages for 2 years 1914 and 1915	
		Fresh forage	Silage
Number of days		141.0	141.0
Fresh forage consumed per 4 cows	lb.	61 186.5	—
Grain » » 4 »	lb.	5 408.0	4 263.0
Silage » » 4 »	lb.	—	16 231.0
Hay » » 4 »	lb.	—	3 933.0
Milk produced » 4 »	lb.	13 480.75	11 120.95
Average % of fat	lb.	4.29	4.18
Hours of man and horse labour		247.57	189.32
Grain required per 100 lb milk	lb.	41.81	40.30
Fresh forage » » 100 » »	lb.	470.50	—
Silage » » 100 » »	lb.	—	155.73
Hay » » 100 » »	lb.	—	36.74
Labour » » 100 » »		1.813	1.245
Dry matter » » 100 » »	lb.	149.975	110.555
Crude protein » » 100 » »	lb.	14.567	10.472
True protein » » 100 » »	lb.	11.35	8,044
Net energy » » 100 » »		101.614	65 397
Weight of cows at beginning	lb.	901.2	1 050.0
» » » » end	lb.	990.5	1 016.5
Acres of ground required per 4 cows	lb.	2.445	1.665

1027 - **Potatoes as a Forage Crop.** — See No. 1047, of this *Review.*

1028 - **Notes on the Inheritance of Colour and Markings in Pedigree Hereford Cattle, in England.** — PITT, F., in *Journal of Genetics,* Vol. IX, No. 3, pp. 281-302, pl. VII IX, figs. 7, bibliography of 12 works.

Notes made on the pedigree Hereford cattle at Bridgnorth, Shropshire.

Before considering the manner in which different characters are inherited, the author gives a short description of this race. A typical Hereford is a deep red beast; face and underparts and feet white; white patch along top of the neck; white at end of tail (1) Points that breeders attend to are the coat colour which should be rich purple red and not yellow: a clear clean nose, without spots and markings; and the horns should be free from pigment at the tips.

The following variations have been observed:

I. — REDUCTION OF THE PIGMENTED AREAS OR EXCESS OF WHITE (2). — This variation is most frequently met, certain families being known to " throw white " occasionally.

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(1) See Grade 0 on appended Plate.

(2) See Grades 1-2-3-4 on Plate.

The factor " excessive white " acts as recessive to normal colouration. Two producers, namely Lowland Paradigm and Bound's Chance give ample evidence as regards colouration and markings. They were mated with cows homozygous and heterozygous respectively for the characteristic " excessive white. " If these individuals homozygous for the typical markings are indicated by the letters NN, those bearing both factors by NW (i. e. " normal pigmentation " N, and " excessive white " W), then the calves bearing the character " excessive white " should be of the genetic constitution WW. The produce of the above bulls may be set forth as follows.

	NN or NW		WW
Lowland Paradigm **NW** × 5 cows **N W**	12	:	5
Bounds Chance **NW** × 6 cows **N W**	13	:	5
Totals	25	:	10
Expectation . . .	26.25	:	8.75

	NN o NW		WW
Lowland Paradigm **NW** × 5 cows **NN**	13	:	0
Bounds Chance **NW** × 13 cows **NN**	39	:	0
Totals	52	:	0
Expectation. . . .	52	:	0

	NN		NW		WW
Bounds Chance **NW** × 4 cows **WW**	0	:	7	:	9
Expectation. . . .	0	:	8	:	8

The above evidence shows that the factor W in Hereford cattle acts as a simple Mendelian recessive to the normal type of markings, normal and badly marked cattle occurring in the ratio of 3 : 1 where heterozygous individuals are mated together.

In addition to this, though the somatic effect of the white factor varies somewhat, each beast having white beyond the shoulders may be confidently assumed to be a homozygote of the constitution WW.

II. EXTENSION OF THE PIGMENT OR DARK NECK. — The ordinary white-necked marking has disappeared and the " dark necked " type of pigmentation shows a distinct tendency to dominance (1).

In the case of a cow called Shelsey Cypress that was dark-necked, only 2 out of 6 calves, all by normally marked bulls, have shown any white on the neck. Presumably the cow was a pure dominant for the character " dark-neck, " the sires being heterozygous. However, dominance is not always complete seeing that white shows in some of the heterozygous offspring. This is evident in the adjoining pedigree table (page 1300) in which D indicates the character " dark-neck, D" the normal colouration and W excessive white.

According to this evidence, it may be concluded that when the factor N alone is present, D is dominant, whilst it becomes more or less recessive in the presence of the factor W.

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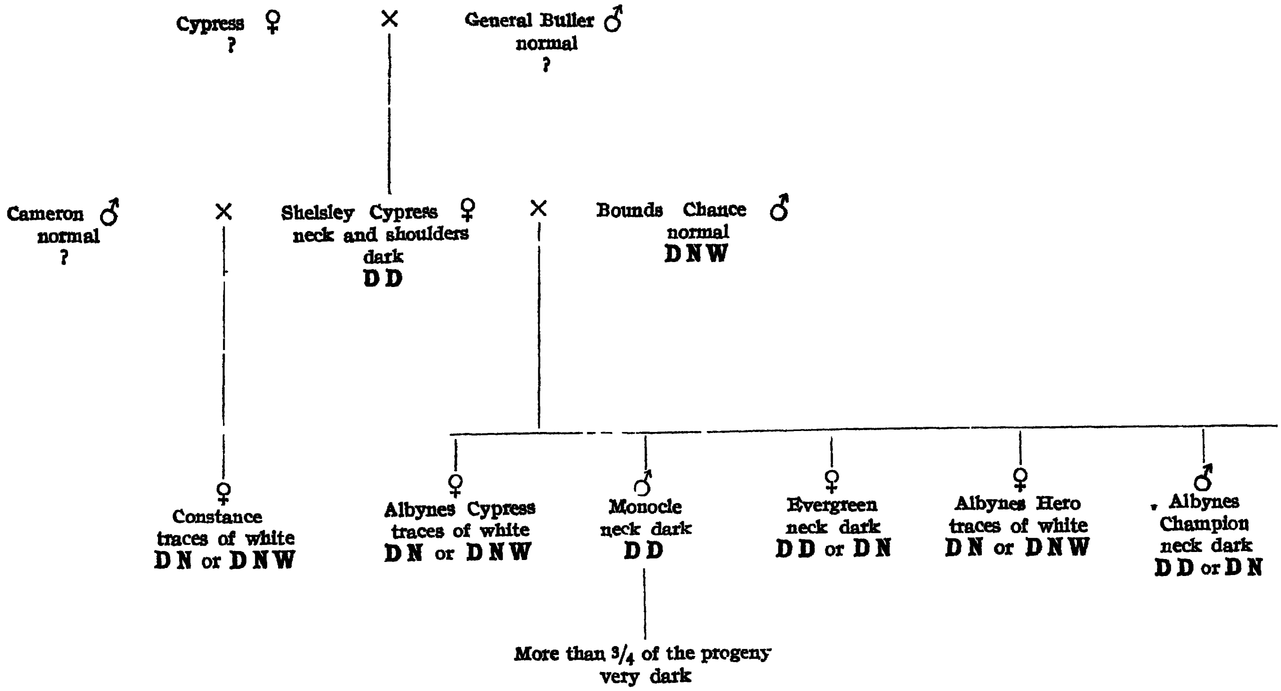
(1) See *grade* + 3 the Plate.

PEDIGREE SHOWING THE APPEARANCE OF WHITE IN HETEROZYGOUS DESCENDANTS.



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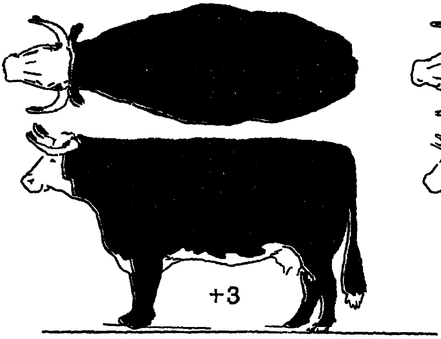

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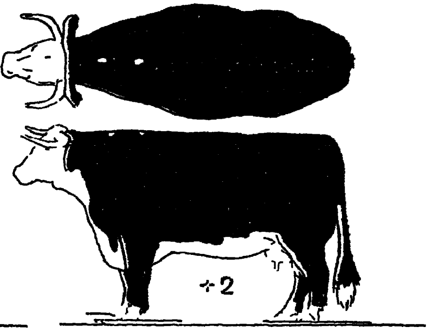

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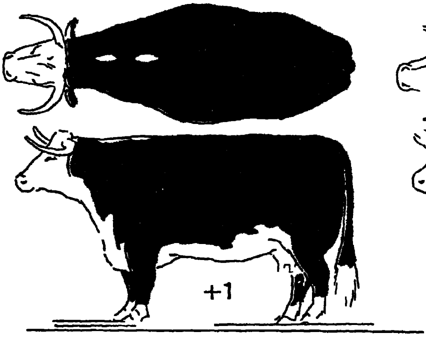

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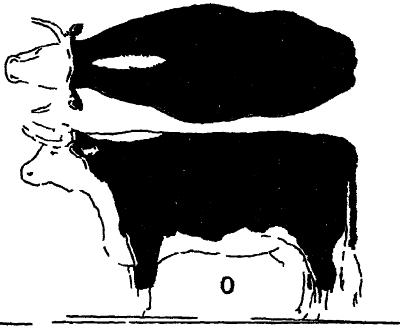

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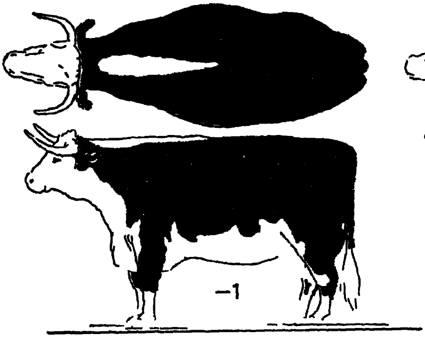

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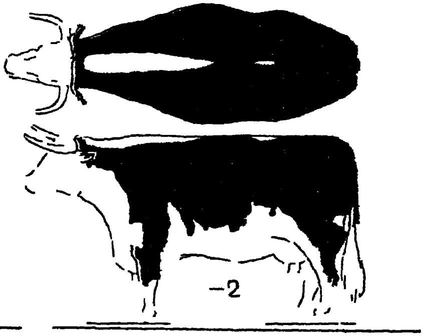

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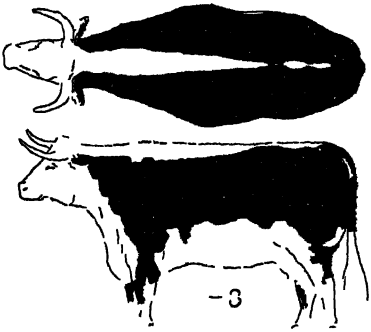

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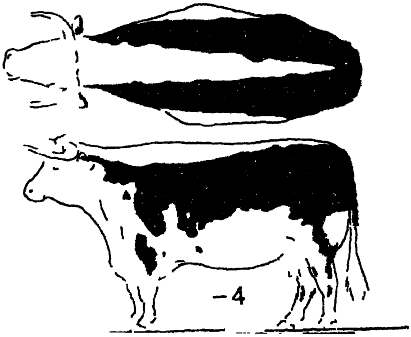

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III. RED-EYES. — A character quite common in English Herefords about $^1/_4$ of the cattle showing it (out of 110, 73 showed more or less colour, about their eyes), though it has never been the subject of selection, the breeders not regarding it as of any importance (1).

The coloured area varies considerably from a comparatively large circle of red round each eye to only a slight trace of pigment.

A study of the factor (R) has shown that the presence of pigment round the eyes is dominant which is allelomorphic to its absence, and this factor segregates independently of other pigmentation factors in the simple ratio of 1 : 2 : 1. But dominance is not so complete in every case, so that the RR and Rr classes are not always easy to distinguish with certainty. It is possible and even probable that the factor N has a modifying or partially inhibiting effect on the full somatic expression of the factor R, so that a normally marked red-eyed beast would not have such well-marked eyes as a dark-necked red-eyed one, though both would transmit the factor R in equal purity to their offspring.

IV. DARK OR DIRTY NOSE. — The pigment sometimes appears on the nose in Hereford cattle in quantities varying from a mere spot or two up to completely dark nose. The black or "blue" (dilute black) spots are considered the worst. Observations concerning the black and brown and black combined have already been made. This form of "dirty nose" is usually found accompanying that deep rich coat colour known as claret. Out of 41 Herefords examined, which were of this tint, 15 had pigment on the nose and 26 had clean noses. The dirty nose is clearly a unit character dominant to the factor R and segregating independently of the other factors with the possible exception of the factor for the rich claret coat. The author for example noted a very white cow (grade—3) with a heavily spotted nose and dark cattle (grade +3) with perfectly clean noses. The figures collected in relation to this transmission of character are as follows:—

	Clean nose	Spotted	Heavily pigmented
Dark-necked + 3 and + 2	7	1	0
Very white — 2 to — 4	7	0	1
Claret coloured	26	0	15
Pale brown	9	0	2

The matings of clean-nosed (pp) with dirty-nosed cattle (PP) may be summarised as follows:

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(1) In certain countries, for example in Jamaica, cattle with pigment made their eyes are actually preferred on account of their supposed immunity to the attacks of flies and certain eye diseases. (*Author's Note*)

	PP		Pp		pp
Newton Plum **PP** × Newstead **pp**	0	:	2	:	0
Newton **PP** × Bounds Chance **pp**	0	:	2	:	0
Total	0	:	4	:	0
Expectation	0	:	4	:	0
6 clean-nosed cows **Pp** × Newton Glance **pp**	0	:	3	:	3
Expectation	0	:	3	:	3

V. — COAT COLOUR WITH REFERENCE TO THE CLARET AND PALE BROWN SHADES. — The rich claret is the deepest shade found in Hereford cattle, yellow (actually a pale red brown) being the lightest, but intermediate shades are often met with.

The claret factor (C) proves to be recessive to that of pale brown (B) as the matings of 7 yellow Herefords with 2 bulls rich claret colour, resulted in 14 pale brown calves to 1 dark. This is somewhat surprising as, judging by analogy with chestnut and bay horses, it would be expected that the paler colour would prove recessive.

The matings claret × pale brown and claret × claret show the following results:

7 matings **BB** × **CC** = 14 **BC** : 1 **CC** Expectation 15 **BC**.
10 » **CC** × **CC** = 33 **CC** : 1 **BC** » 34 **CC**.

The factors for coat colour segregate independently of others controlling the distribution of pigment, but the factor C is often associated with factors R and P; this may be as follows:

Excessive white

Pale brown	Claret
$\overbrace{1\ \mathbf{WW} : 10\ \mathbf{NN}\ \text{or}\ \mathbf{NW}}^{11}$	$\overbrace{2\ \mathbf{WW} : 39\ \mathbf{NN}\ \text{or}\ \mathbf{NW}}^{41}$

Dark neck

Pale brown	Claret
$\overbrace{3\ \mathbf{DD}\ \text{or}\ \mathbf{DN} : 8\ \mathbf{NN}}^{11}$	$\overbrace{8\ \mathbf{DD}\ \text{or}\ \mathbf{DN} : 33\ \mathbf{NN}}^{41}$

Dirty nose

Pale brown	Claret
$\overbrace{2\ \mathbf{PP}\ \text{or}\ \mathbf{Pp} : 9\ \mathbf{pp}}^{11}$	$\overbrace{15\ \mathbf{PP}\ \text{or}\ \mathbf{Pp} : 26\ \mathbf{pp}}^{41}$

Red eyes

Pale brown	Claret
$\overbrace{7\ \mathbf{RR}\ \text{or}\ \mathbf{Rr} : 4\ \mathbf{rr}}^{11}$	$\overbrace{37\ \mathbf{RR}\ \text{or}\ \mathbf{Rr} : 4\ \mathbf{rr}}^{41}$

[1028]

Notes on the history of Hereford cattle with reference to their markings and variations show that the pigmentary characters are survivals from earlier times when no selection was practised of colour or markings. Hence the faults which appear and reappear in the present-day Herefords should not be attributed to spontaneous variations, but are due to Mendelian factors carried by the animals which cause the characters concerned to appear, when suitable combination of gametes gives them the opportunity.

1029 - **Cyrenaica as a Stock-Breeding Country.** — FRANCHI, Q. (Veterinario coloniale presso il Governo della Cirenaica), in *Il nuovo Ercolani*, Year XXIV, Nos. 15-19, Bibliography of 15 works. Turin, August 15-September 30, 1919.

Observations and suggestions based on the study of what other authors have written on the subject, together with a comparison between these data and the facts observed by FRANCHI himself during his stay in the Colony, which lasted for several years.

The author thinks that, in spite of the present depression, stock-breeding and the allied branches of industry will ultimately become the chief source of wealth in Cyrenaica. Good results can, however, only be expected, if thrifty animals are obtained which can live upon the wild herbage, and support periods of scarcity of forage. Thus, sheep-breeding (the travelling method is the most suitable and is usually adopted) occupies the first place, and cattle-rearing the second. The physiological condition of the native cattle is deplorable, but could be radically improved by adoption of better breeding methods.

The massif of Cyrenaica is formed of limestone rocks ; the large amount of " terra rossa " (red earth) being only the ferruginous, calcareous, residual clay typical of regions where the limestone has undergone alteration.

Next to the limestone, but confined to the coast district, there is a sandstone, which although very soft and friable in the West, becomes much more compact and hard towards Bomba and Toubrouk. The thin strata of clayey limestone that predominate near Solloum, are intercalated with these sandstones. At Solloum, the red earth disappears, but the soil remains of a clayey-calcareous type. Other thin strata of compact, impermeable marl or clay are interbedded with the great limestone mass of the plateau.

Although the flora of Tripolitania is typical of the Sahara region, that of Cyrenaica is of the Mediterranean type.

The author rapidly reviews the districts that may be regarded as of real agricultural importance ; he mentions all the coast zones and those situated in the mountainous region, and on the plateau which is a continuation of the hilly country but leaves out of account the interior zones of the oases and the pre-desert.

The innumerable oases serving as pastures, which are scattered along the coast and over the plateau are the most suitable grazing-grounds for animals reared in the open. They represent fertile patches which have escaped the inroads of the desert sands, and the encroaching of bushes and shrubs.

The stock-breeding problem of Cyrenaica may be stated as follows: It is necessary to provide means for increasing the herds and flocks, improving the stock, and finding a market for the produce.

It is impossible to distinguishe any varieties or sub-groups in the domestic animals of Cyrenaica. Each breed is descended from a single ancestral stock, yet the progeny are not fixed enough in character for it to be possible to classify them as distinct types. The differences between the animals of the same race are almost entirely due to their place of origin, and the manner in which they have been reared.

The *horses* are few in number and are evidently of Berber breed, although some individuals show traces of inter-breeding with oriental-mesomorphic types. It is difficult to find animals with the distinct characters of the Arab horse. All the horses of the Colony have 3 fixed characters:— Convex frontal region (hare's head), thick neck, sloping croup, somewhat narrow at the gluteus.

Extreme measures of ordinary native horses taken by the author.

Weight to top of withers	from	138	to	153	cm.
Oblique length of trunk	»	140	»	162	»
Width of chest	»	27	»	39	»
Length of thorax (from the point of the shoulder to the posterior border of the last rib)	»	81	»	94	»
Circumference of thorax	»	158	»	179	»
Circumference of fore cannon-bone	»	17	»	20	»

Rearing, in the strict sense of the word, does not exist. The horses are sufficiently strong for riding (for which they are generally used), and also for draught work.

The *donkeys* are small; they usually have a grey coat with the mule stripe, or cross, or else a brown coat with light areas on the belly, on the inner part of the thigh, and round the eyes and mouth. Black coats are an exception. There are not many donkeys, and they decrease in number as one advances towards the interior. On some parts of the coast, larger donkeys are found which are of the Pantellerian type, and are probably descended from imported animals of that breed.

Mules are very rare.

The *dromedaries* belong to a special breed, produced by crosses with animals from Egypt and the Sudan. There is a fairly large number of these camels; some droves contain excellent specimens. They are used as beasts of burden, and by caravans. None are specially bred as running-camels or "méhari." Their coat is usually of different shades of fawn.

Cattle are the animals that suffer most from the unfavourable conditions of the environment; there are, however, some individuals that would well repay selection. There is but one breed, and this the author does not believe to belong to the Iberian stock. The coat is generally wheat-coloured, sometimes spotted, rarely black. A large number of the cattle suffer from cysticercosis. The cows, though bad milkers, have well-shaped udders.

Extreme measurements of dromedary taken by the author.

Height at top of withers	from	165	to	182	cm.
Depth of thorax measured to half the sternal callosity	»	77	»	96	»
Oblique length of trunk	»	168	»	194	»
Circumference of thorax	»	179	»	235	»
Circumference of fore cannon-bone	»	19	»	25	»

Weight at top of withers	from	99	to	122	cm.
Weight at sacrum	»	104	»	127	»
Length of thorax (from point of shoulder to posterior border of last rib)	»	51	»	87	»
Oblique length of trunk	»	118	»	178	»
Circumference of fore cannon-bone	»	16	»	20.5	»

The *sheep* belong to the Syrian breed (Berber variety), but they are of different sizes, and show no uniformity of type. They have abundant wool of an open texture and varying in colour from dirty white to black with apical pigmentation. It is surprising to see the number of anomalies in shape and form presented by these animals: horns and supernumerary members, monorchidia, cryptorchidia, hermaphrodism, epispadias, and hypospadias. Usually, they are in good condition, and not infrequently, the dead weight of the sheep at the local butchers is over 40 kg.

As the author has observed, there are two forms of steatopygia:—

(1) In which the fat deposit is strictly confined to the tail;

(2) in which it extends to the croup; this is called the " fat rump type ". These forms occur independently of the animal's state of nutrition.

Extreme measurements of sheep taken by the author.

Weight at withers	from	60	to	73	cm.
Oblique length of trunk	»	71	»	88	»
Depth of chest	»	21	»	25	»
Circumference of thorax	»	88	»	104	»
Circumference of fore cannon-bone	»	9	»	11	»

The *goats* are fine animals and in good condition: few of them are, however, kept and then usually reared with sheep. The goats of Cyrenaica belong to the breed of *Capra hircus* Helleri. Their hair is long, and their coats generally white, grey, or spotted, seldom black. The females as a rule, yield abundance of milk.

The *fowls*, which all belong to one native race, are very numerous, and excellent layers although they are rather small, light birds.

The *pigeons* are of different types belonging to various breeds, and are somewhat small.

In conclusion, the author points out the course to be followed in order to improve the stock of the Colony and says that it is absolutely necessary for the Government to take the initiative. The first thing is to increase the native domestic breeds, which present no difficulties, as pastures are not lacking. This should be followed by the draining of the marshy land.

In order to encourage stock-breeding in Cyrenaica, it is requisite to: 1) Increase the domestic animals as rapidly as possible; 2) Improve the local species, especially by crossing and selection; 3) Change the environment and solve the forage question; 4) Ensure sufficient reserves of water for the stock and for irrigation purposes; 5) turn to best account the capabilities of the animals, and place their products on the market; 6) found a Stock Breeding Station provided with all the apparatus required for experimental work. Affiliated to the chief Station, there should be zonal stock-breeding sub-stations for the purpose of propaganda and supervision; 7) develop the Veterinary Service for prophylaxis and sanitary inspection; 8) make quarantine stations for stock that is to be imported or exported; 9) encourage the installation of cold-storage plants in the chief coast-towns.

As regards the means of selection, the author advises:—

For *horses*, the use of eastern stallions and mares to the total exclusion of European animals.

For *mules*, extensive breeding with donkeys imported from Pantelleria.

For *dromedaries*, the selection of good local types, and the castration of the young males not needed for breeding purposes, in order to increase the meat supply.

For *cattle*, the selection of native animals, the larger importation of the Sicilian breeds that have given good results and the castration of calves not needed for breeding. In the marshy districts (Bomba), zebus and buffaloes might be tried.

For *sheep and goats*, careful breeding and choice of breeding-animals, for the stock is already good. The castration of lambs destined for the butcher is also necessary.

For *fowls*, the introduction of early-maturing breeds.

1030 – **The Present Condition of Stock-Breeding in Hungary.** — VON KONKOLY-THEGE, A., (Secretary of the Hungarian Agricultural Society) in the *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No. 42, p. 318. Berlin, May 1921.

A short report on the Twentieth National Show of Breeding-Stock at Buda-Pest. This show, which was the first since the outbreak of hostilities, demonstrated that in spite of the war, Hungary still possesses sufficient cattle to form the basis of a national industry.

Considering the reduction of Hungarian territory, the number of exhibits was very satisfactory. Most of the cattle were pure-bred Simmenthals, but there were a large number of crosses between the Simmenthal and the local pied-red breed. The grey Hungarian steppe cattle had few representatives.

Most of the sheep were either combing-wool Merinoes, or early-maturing Merinoes, the Peace Treaty having deprived the country of most of the sheep farms where the animals supplying wool for textile fabrics used to be bred. The pigs consisted almost entirely of animals belonging to the Hungarian Mangalicza breed, there being but very few of the early-maturing foreign breeds, although these are now in great demand.

The following prices are paid for breeding-animals (males and females): — Cattle 38 000 to 150 000 kronen; pigs 10 000 kronen; sheep 8450 kronen.

1031 - **Study of the Cattle-Breeding Situation in South America (Brazil, Uruguay, Argentina) Especially as Regards a Possible Market for Swiss Cattle.** — LUTHY G, (Gérant de la Commission des Fédérations suisses des syndicats d'elevage bovin), in the *Annuaire agricole de la Suisse* Year XXII, Pa,, vol. 2, pp. 49-70. Lucerne, 1921.

Report on the present condition of cattle-breeding in South America, especially in Brazil, and of the cattle shows at Rio de Janeiro, Montevideo, and Buenos-Ayres in 1920.

The author, who was one of the judges of the dairy-cow division at the Rio Janeiro show, has studied the present condition of cattle-breeding in the country, the improvement obtained by the introduction of foreign, especially Swiss, races, and the possibility of finding a sale for Swiss cattle in South America.

BRAZIL (1). — Among the cattle on show at the third National Cattle Exhibition, opened on July 4, 1920, there were 67 of the Brown Breed and 20 of the Spotted Breed; the Black Spotted Breed, on the other hand, had not a single representative.

In the milch-cow division, there were amongst others, Dutch, Norman and Flemish animals, as well as specimens of Jerseys and Guernseys. The following figures show the proportion in which the various breeds were represented at the Show:— Zebu 294; Caracu 14; Hereford 301; Polled Angus 20; North Devon 16; Shorthorn 39; Red Poll 20; Simmenthal 20; Schwyz 67; Limousine 16; Normandy 15; Flemish 13; Dutch 108; Guernsey 20; Jersey 30; Local breed ("Animaes Nacionaes") 12; Red Lincoln 5; Milch cows of various breeds 7; Total: 1027 head.

The author thinks that Swiss cattle would find a ready sale in Brazil, if more active propaganda were made by sending well selected animals of the Swiss breeds to shows in that country, but they would find serious rivals in the English beef breeds which are already well-represented there.

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(1) See: *R* Jan. 1915, No. 80; *R.* Nov. 1915, No. 1183; *R.* July 1921, Nos. 700 and 767. (*Ed.*)

The Brazilian breeders are now fully aware of the necessity of paying serious attention to the improvement of the native races. Good results will certainly be obtained as soon as there are better means of communication, and when the control of "tristeza" is more effective, and the question of breed solved. The author has had the opportunity of visiting many large farms and "fazendas" in which he found cows belonging to the Brown breed, and the Red spotted breed; some of the animals being pure-bred, others cross-bred. The "Posto zootechnico de Pinheiro" which is State property, is a model farm on which are kept the most different races of cattle of Brazilian or European origin. Amongst others, there are 80 head belonging to the Brown and Spotted Red breeds, that were purchased in Switzerland in 1919; some of the consignment succumbed to "tristeza". The animals have retained their shape and points, but have lost flesh, owing, it is supposed, to the condition and situation of the land.

On another large "fazenda" at Paysandu, belonging to Dr. JONQUIERRE, there was a herd of 880 cows belonging to the brown breed, mostly hybrids, but still showing the breed characters; the animals were in good condition. The author believes that great improvement could be effected though the infusion of fresh blood by bulls imported directly from the home of the breed. Further, since the price of milk is rising, the milk-industry will undoubtedly develop in this region. According to the proprietor, the average daily milk yield is 8 litres, wich in proportion to the total returns obtained from the estate, is very satisfactory.

On another farm (Santa Cecilia à Volta Redonda), the herd consists of 1000 head of cattle, of which 60 belong to the brown breed; the rest being the products of a cross between that breed and the local « "Caracu" race.

Afterwards, the author visited CARNEIO's farm situated in the basin of the Parahyba, in the State of Minas Geraes, where the dairy industry has made more progress.

Cattle-breeding is chiefly practised in the south, whereas in the north horse and mule-breeding are more in favour.

A large number of the beef cattle (local breed) required to provision Rio de Janeiro comes from the above State. The remainder are sent from a greater distance, from the States of Matto Grosso and Goyaz, but as the animals make three journeys, which takes from 2 to 3 months, on foot, they lose much of their weight on the way, and have to be re-fattened on the pastures in the States of Minas Geraes and Rio de Janeiro before being sent to the abattoir. No Swiss cows were met with, except some animals, resembling the Simmenthal bieed to a certain extent as regards their coat but having more or less assumed the shape of the indigenous races ("Caracu") or of the zebu. It is in this State that Swiss cattle, especially the brown breed, would have the best chance of success.

The "Campo Alto" fazenda in the State of São Paolo, possesses several bulls of the Swiss Brown breed, which in spite of their age (one is more than 10 years old) are still vigorous and fit for service. Two young bulls (11-15 months old), bred on the premises, left much to be desired as regards symmetry and development, and their coat was too light in colour. Splendid results have been obtained by crossing Swiss Spotted Red cattle with the local (" Caracu ") breed. Two oxen ($^3/_4$ Simmenthal ¼ Caracu), which were being fattened, showed no signs of mixture of blood in their horns, ears, muzzles, or hoofs. Eighty cows, the products of a cross between the Caracu and Spotted Red breeds (although only of ½ or even ¼ Simmenthal blood), were superior in shape and milk yield to the pure-bred Caracus, and weighed on an average from 200-250 kg. more per head. The average daily milk-yield of this herd was 8 to 9 litres per cow, whereas that of the Caracus never exceeded 3-4 litres. Amongst other estates, the author also visited that belonging to the São Paulo Stock-Breeding Station. In the model cow-shed there, he saw imported Shorthorn, Jersey, Guernsey, Limousine and Dutch cows which were being acclimatised, and undergoing immunisation; the results obtained by inoculation against tristeza are said to be most satisfactory. In short, the author found that the brown breed is well represented numerically in Brazil, but that the quality of the animals is very inferior. The Spotted Red breed, on the other hand, is but little known As regards the breeding conditions in Brazil, the author does not think that the English beef breeds are likely to establish so firm a footing there as to crowd out all other races, which has hitherto been the case in Argentina and Uruguay. The Dutch cattle, however, though represented by many specimens in farms situated near the towns, do not appear to have succeeded as well as the Swiss dual-purpose breeds.

So far, land-owners have manifested a market preference for the zebu imported from India. Zebus belong to a primitive race, and are very thrifty, and resistant to diseases, thus needing little care, which is a great advantage in Brazil. They are well enough adapted to regions where cattle are kept to provide manure, but as the demand for animal products increases in other countries, the zebu of the Brazilian farm will be obliged to retire in favour of European breeds.

Taking these data as a basis, the author has sketched out the outlines of a scheme for importing Swiss cattle into Brazil

He demonstrates the necessity of establishing agencies and creating a Swiss-Brazilian Society to purchase or rent an estate where a large herd of cattle can always be kept, so that the animals are immunised against " tristeza " and can become accustomed to living in a climate, and under conditions, differing greatly from those obtaining in their native country.

According to the author, the most formidable rivals of the Swiss cattle on the Brazilian market will be British and North American animals. Powerful associations, with much British and American capital behind them, have already been formed in the State of São Paulo for the purpose of installing abattoirs and cold-storage plants. It is certain, that, by these means, an impetus will be given to the rearing of English beef-breeds of cattle, and to their exportation to Brazil. The great difficulty in the way of importing Swiss cattle is the deficiency of means of transport. As regards show cattle, the author advises their being sent in good time, so as to be able to spend at least 2 months in Brazil, and thus become somewhat acclimatised before exhibition.

URUGUAY (1) has followed the example of the Argentine Republic in the measures taken for improving its cattle and in organising large annual shows. The results obtained in a short time are most encouraging. Uruguayan breeders have specialised in Herefords, and seem to have a clear idea of the objects for which they are breeding.

With the exception of Herefords, which are preferred, almost the only European cattle in Uruguay are Shorthorns.

Thus, at the Fifteenth Show at Montevideo, there were 104 Hereford, 93 Shorthorn, 5 Normandy bulls (one being 2 ½ years old), 1 Jersey, and 1 Dexter bull. Hardly any cattle are reared in Uruguay for the frozen-meat trade, and it would be difficult, at all events for the present, to introduce other breeds into the country. Huge cold-storage plants have been installed by the important firms of SWIFT and ARMOUR at Montevideo.

Another institution existing at Buenos Ayres, as well as at Montevideo, and which deserves serious attention is the many public auctions where Herefords and Shorthorns are sold. A first-class Shorthorn bull was purchased at such a sale for 110 000 pesos (270 000 francs at the then rate of exchange); other bulls fetched respectively 70 000, 100 000, 170 000, 130 000, 150 000, 180 000, 200 000, and 250 000 fr.

ARGENTINA (2). — The conditions of cattle-breeding in the Argentine Republic are quite different. Although the English beef-breeds, Short-horns, Herefords, Polled and Aberdeen Angus, still take the first place, more attention has for some years been devoted to dual-purpose cattle. The Brown breed is wholly unknown in Argentina, but there are several specimens of the Black Spotted Fribourg cattle; these, however, show marked signs of degeneration. The Red Spotted breed is only known by name.

When importing Swiss cattle, it is of paramount importance to Argentina that the animals should be healthy, vigorous, and accustomed to mountain pastures.

The Show opened on Sept. 4 1920, included among the exhibits, representatives of the following breeds:— Shorthorn 1315; Polled Durham 4; Hereford 229; Aberdeen Angus 130; Red Poll 2; Shorthorn (red) 4; Flemish 9; Jersey 4; Normandy 11; Fribourg 7; Dutch-Friesian 31; Holstein Friesian 34; total: 1780 head.

In paying the above-mentioned high prices for service bulls, the Argentine or Uruguayan breeder pays for a pure-bred animal of long and good pedigree which is vouched for by absolutely trustworthy documents. Further, the author found on enquiry in both Argentina and Uruguay, that all the regulations connected with the Herd-books emanate from a single source, and are identical for all breeders of the same cattle. There is only one Herd-book for the shorthorn, Hereford, and Aberdeen

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(1) See: *R.* May 1917, No. 466 and June 1917, No. 517. (*Ed.*)

(2) See: *R.* Mar. 1916, No. 264; *R.* Aug., 1917, No. 1123; *R.* July-Sept. 1919, No. 950. (*Ed.*)

Angus breeds respectively. In the Argentina Shorthorn Herd-book, no animal is registered whose pedigree cannot be traced back to the English Herdbook of 1850. More importance is attached to the pedigree of stock in Argentina than in any other country in the world, except England. Brazil is still in the preliminary stage, but is taking an interest in this matter. In all the states of South America, the greatest efforts are being made in the direction of systematic improvement of the different breeds of cattle.

Both in Argentina and Uruguay, the annual cattle shows are organised by Agricultural Societies, and not by the State. To these Societies are also intrusted the keeping and supervision of the Herdbooks, and of all the pedigree-registers of every kind of animal; while to their initiative must be attributed the efforts made to improve the agricultural conditions of all the large estates.

Since cattle shows have been instituted, and especially since the Centenary exhibition of 1910, the cattle exhibited have always been judged by English judges who are experts, in as much as they supplied the selected stock. Very severe supervision is exercised.

As regards how much show animals should be fattened, which is a question much discussed in Switzerland, Germany, and elsewhere, the author has observed, that all the beasts exhibited in Argentina are in prime condition. The prize breeding-stock (bulls and cows), which head the list are extra-fat cattle although the breeders admit that so much fat is injurious to the health, and diminishes the reproductive powers of the animals yet the idea is so well established that even breeding stock should be fat, that a lean bull or cow, would have no change of bring awarded a prize.

1032 – **The Guernsey Breed in Latium** (1). – SENNI, G., in the *Rivista agricola romana*, Vol. XLVII, No 8, pp. 210-214. Rome, August 1921.

In reply to questions sent to him by the President of the Comizio agricolo di Roma, the author makes the following statements :—

One bull-calf and one cow-calf (6 months old) were imported by him from Guernsey in 1910, and 4 cows in 1912. These animals were successfully crossed with Swiss and Dutch cattle, but finally it was resolved to specialise on the pure Guernsey breed.

The weight of the adult animals varies from 350 to 400 kg. The third generation hybrids obtained by the author appear to put on weight in a very satisfactory manner, as has been observed in the United States (2). The average milk of yield adult cows fed on local ordinary forage is about 3000 litres. The milk retains its characteristic richness in cream, its flavour is very delicate, and its colour generally yellowish.

The breed is easily acclimatised. To ascertain this fact, the author made a special experiment on his farm at Grottaferrata where he kept some Guernsey cows in the open winter and summer, for several years. They were given local forage, often even to the exclusion of concentrates. The readiness with which this breed becomes acclimatised is also proved by its being exported to France, England, Denmark, Sweden and the most different parts of the United States, where very pure-bred herds have been formed.

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(1) See : *R.* July 1916, No. 777.

(2) See. *R.* Jan. 1917, No. 61. (*Ed.*)

The 60 animals bred by the author, though examined every year, were found to be free from tuberculosis; but occasionally they suffered from sublingual abscesses due to the forage which was sometimes coarse. The cows that were first imported are now 11 yeais of age, yet still give plenty of milk. The author has seen in the island of Guernsey a cow of the native breed, 16 years old, with a fine little calf of 2 months, and still giving abundance of milk. Such cases are not rare, indeed as a general rule, cows belonging to breeds that have been greatly improved, continue to serve their special purpose much longer than less well-bred animals.

The author does not think it advisable that Guernsey cattle should be widely kept at present in Latium, for it is necessary that much progress should first be made in the production of forage and the care of stock. Under present conditions, this breed can only be reared successfully in exceptional cases, by a few expert breeders.

1033 - **Sorghum for the Intensive Feeding of Pigs.** — GOUIN, A., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VII, No. 27, pp. 588-592. Paris, July 13, 1921.

The author calls attention to the feeding value of sorghum grain, and shows the excellent results he obtained with it in intensive pig-breeding.

There is only one cereal superior to sorghum as a pig-feed and this is maize, which has a higher fat content.

Sorghum is as nutritious as wheat, barley, rye or manioc :— 100 kg. of sorghum is equivalent to 125 kg. of oats or 140 kg. of buckwheat.

The nutritive quality of sorghum is as high as that of groundnut cake, although its composition is completely different. Sorghum is 15 % more nutritious than palm-oil cake, and 30 % more than oil-free palm-oil meal. It is readily eaten by stock.

In the author's experiments, young pigs fed sorghum and skim milk gained 5 kg. per week, as soon as they had attained the weight of 20 kg.

When given skim milk and 200 kg. of sorghum, a young pig can put on 75 kg. of fat meat in a little less than 4 weeks. This meat costs very little, as sorghum can be bought for 35 francs per 100 kg. in those districts in France where it is cultivated.

If there is no skim milk obtainable, 500 gm. of groundnut cake and a good handful of bone-meal per pig must be added to the sorghum. In this case, it may be calculated that 220 kg. of sorghum, 70 kg. of groundnut cake, and 10 kg. of bone-meal will be needed to produce 75 kg. of fat meat.

The Nantes experiment centre is engaged in trying to make sorghum popular among small breeders.

1034 - Experiments Made in the United States on the Respective Values of Green Feeds as a Preventive of Intestinal Disorders of Growing Chickens. — PHILIPS, A. G. (Chief in Poultry Husbandry), CARR, R. H. (Associate in Nutrition), KENNARD, D. C. (Assistant in Poultry Husbandry, Purdue University Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XX, No. 11, pp 869-873. Washington, D. C., March 1921.

Report on experiments carried out in 1919 at Purdue University Agricultural Experiment Station, with a view to finding some appropriate means of checking intestinal putrefaction, the principal cause of mortality of chickens raised in confinement. It was decided to try a series of different compounds which might be expected to have an antiseptic effect or might serve to prevent constipation.

The stock used was 160 White Leghorn day-old chickens which were divided into 10 lots of 16 chickens each.

During the first 4 days, the chickens in all lots were given water and maize. Each bird was marked and the weight was recorded.

Each lot was then given its respective ration. The basal ration given to all lots consisted of 50 parts cracked maize, 35 parts maize meal, 15 parts maize bran, 3 parts ash, 8.86 parts meat scrap, and 10.9 parts soybean meal (all parts by weight). To this basal ration was added the substances indicated in the adjoining Table.

The addition of copper sulphate appeared to have the most beneficial and antiseptic effect as regards a preventive of intestinal putrefaction and consequent mortality. As to the use of sprouted oats, thought by some to be effective in lessening mortality, especially when fed for a short time only and when given as a supplement to a somewhat monotonous ration, in the present experiments no directly beneficial effect was evidenced.

The sulphur caused a continued looseness of the bowels; however, up to 8 weeks of age this was one of the best lots.

The retarding effect of tobacco was pronounced and resulted in stunting the growth during the first 8 weeks. There was a tendency, however, for the chickens to recover somewhat by the age of 14, weeks, but they always seemed more wild and nervous than those of any of the other lots.

The use of hydrochloric acid in the drinking water seemed to be of some benefit seeing that the mortality was somewhat less than the average and the growth was consistent throughout the experiment.

Strawboard pulp, supplied to the ration for the purpose of adding bulk and thereby lessening the danger of impaction of the small intestine and caecum common when feeding a grain ration, did not seem to aid in reducing mortality.

The lots given a litter of oat straw to encourage the chickens to exercise, did not prove successful as regards growth nor was the mortality lessened. This ration has proved its efficacy in promoting growth but has also proved its inefficiency in checking mortality, especially during the 8th and 14th weeks.

Lactose added to the ration did not seem to aid in lessening mortality or in promoting growth. This may be due to the fact as stated by MENDEL and MITCHELL (1), that birds, unlike mammals, have no sugar-splitting enzymes in the small intestine ; hence the sugar fed was not converted into lactic acid to any considerable extent. In addition to this, the faeces contained the normal amount of uric acid and no soluble ammonium salt where hydrochloric acid was used in the drinking water.

The experiments have shown that hydrochloric acid, sulphur and particularly copper sulphate offer interesting possibilities in raising chickens in confinement.

Substances added to the basal ration and mortality of chickens.

Lot No.	Ration	Age 8 weeks		Age 14 weeks	
		Weight	Mortality	Weight	Mortality
		gm		gm	
1	Basal only	257	0	644	6
2	Basal + straw	252	3	475	8
3	Basal + straw + greens	257	3	524	8
4	Basal + 22 % straw pulp (2)	247	3	630	6
5	Basal + 5 % straw pulp	252	8	638	8
6	Basal + H CL (1 pt 36 % to 500 pts drinking water	305	4	639	5
7	Basal + tobacco (1 : 2)	223	4	535	6
8	Basal + sulphur (1 : 2)	305	5	605	7
9	Basal + lactose (1 : 6)	295	4	617	7
10	Basal + Cu SO_4 (1 pt to 1400 pts water)	306	2	653	2
11	Basal + greens	243	1	384	11
12	Basal + greens	186	3	360	11
13	Basal + no greens	225	5	486	10
14	Basal + greens	205	3	458	8

1035 - **The Introduction of the Italian Bee into Brazil.** — *Chacaras and Quintaes*, Vol. XXIII, No. 6, pp. 456-457. São Paulo, June 15, 1921.

In November, 1920, Prof. E. SCHENK imported twenty swarms of Italian bees which were sent to the Borges de Medeiros Institute. No time was lost there in raising queen-bees according to the most modern methods, and by the end of February 1921, only 10 % of the swarms at the Institute still had black native queens, all the rest having yellow (Italian) ones.

Where an Italian queen-bee was present in a native swarm, it was necessary perforce to allow her to be fertilised by the native males, but since eggs producing males are not fertilised, these queens only produced yellow and not black males. At the present time, all the fertile bees are of the Italian breed, the black males and queens having died or been destroyed.

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(1) MENDEL, LAFAYETTE, B., and MITCHELL, P. H., Chemical Studies on Growth. — I. The inverting enzymes of the alimentary tract especially in the embryo, in *American of Journal Physiology*, Vol. XX, No. 1, pp. 81-96, 1907.

(2) Strawboard reduced to pulp with water. The pulp after most of the water is expelled is mixed with the dry mask.

In its new home, the Italian bee shows its usual characters of gentleness, great activity, and resistance to disease.

1036 - **Results of the 1919-1920 Season of Silkworm Egg-Breeding in France.** — *Ministère de l'Agriculture, Directeur de l'Agriculture, Bulletin Mensuel de l'Office de Renseignements agricoles*, Year XIX, July-December, 1920, p. 353. Paris, 1920.

During the season 1919-1920, the work of the service for the supervision and control of silkworm egg-breeding was carried out by 2 inspectors and 12 controllers; the number of establishments inspected was 62, a larger number than in preceding years.

The weight of the cocoons sent after sorting to the egg-rearing establishments showed a considerable increase in comparison with that recorded for other seasons and rose to 206 256 kg. as against 116 929 in 1916-1917, 115 661 in 1917-1918, and 94 174 in 1918-1919, but was about the same as the pre-war average (of about 207·500 kg.) for the period 1911-1914.

In proportion to the larger weight of cocoons sent to the rearers, the "seed" production showed a great increase, being as much as 14 597.144 kg. (8503 in 1917-1918; 6342 in 1918-1919).

Of the total weight produced 884 6.354 kg. (corresponding to 400 568 boxes) were provided with the official mark, as against 269 727 guaranteed boxes supplied in 1917-1918, and 176 231 in 1918-1919.

These guaranteed silkworm eggs were chiefly despatched to Syria (1382 kg.), Serbia (1157 kg.), Spain (807 kg.), Italy (711 kg.), Japan (472 kg.), etc. A large quantity was also sold in France.

The number of batches of eggs sampled at the rearing establishments and examined at the Draguignan sericultural Station totalled 2142, of which only 1 was found to have been attacked by pébrine, and this but to a limited extent, only 3 % of the eggs being infected.

The results of the season 1918-1919 show, on the one hand, that the silkworm-egg breeding industry, though it has suffered from the general economic depression has recovered, and has now attained its prewar level, and on the other, that the efforts made by the officials of the control service to improve the quality of French silkworm eggs have borne good fruit, as is shown by the manner in which the silk worm rearers and suppliers of "seed" have evidently profited by the advice given to them by the Inspectors on the occasion of their visits to the rearing establishments.

1037 - **Crossing Pure Breeds of Silkworms in Relation to Modern Theories of Hybridisation and Heredity.** — I. GRANDORI, R., (Directeur de l'Institut Séricicole de Trente), in the *Annuario della R. Stazione bacologica di Padova*, Vol. XI-XIII, Part. 2, Padua, 1920. — II. BOLLE, G., in *Allevamenti*, Vol. II, No. 4, pp. 107-108. Palermo, April 10, 1921.

I. — From a careful study of the results of experiments in silkworm crossing made principally by COUTAGNE, QUAJAT and TOJAMA, GRANDORI has arrived at the following conclusions:—

1) On crossing pure breeds of silkworms, the Mendelian laws are found to hold good only to a certain extent, probably on account of the great difficulty of obtaining really pure-bred specimens for the experiment. In any case, whether one character or another follows the laws of Mendel or not, is of little importance in securing new breeds that are resistant to " flacherie ". Nevertheless, the work hitherto accomplished has yielded results that can serve as a guide for further experiments which it is hoped will provide the silkworm industry with new breeds of vigorous hybrids. No steps have so far been taken to attain this practical result by scientific methods.

(2 Mendelism alone would not suffice. In order to obtain the desired breed by this means only, it would be necessary to find, fix and perpetuate as pure dominants, a very large number of characters. Further, in the same combination, numerous other characters, that it is wished to suppress would have to act as absolute recessives. To accomplish all this is practically impossible.

(3 If Mendelism by itself is inadequate, it can nevertheless be of valuable assistance to us in attaining our object, for it may be regarded as a rapid means of resolving the complex of race characters into its component parts. Then is the time for selection, which has been rigorously practised for many generations, to take up the task with the twofold object of reproducing the combinations answering to requirements, even if only to a small degree, and of fixing these combinations in such a manner that they may be reproduced *inter se*. These combinations should above all include those physiological characters that, in spite of their great complexity, and the large number of inherent non-transmissible factors by which they can be modified during the embryonic and post-embryonic development of the progeny, themselves appear to have in the germ-plasm a material *substratum* capable of being transmitted.

The most vigorous oriental breeds must be chosen for crossing with our finest and most profitable breeds, and whatever Mendelism cannot give, must be sought for by means of the careful selection of combinations obtained by segregation, and autonomy.

4) Among the breeds likely to furnish good results, the oriental bivoltins and univoltins must not be forgotten when it is desired to obtain hybrids combining the best qualities of our native silkworms with the disease-resistance characteristic of these foreign breeds.

5) The continued selection that may be necessary to restrain the variability of self-bred hybrids within minimum limits is not so great a disadvantage as repeating the crossing operations every year.

II. — Prof. BOLLE has arrived at similar conclusions from the results of his experiments on the white Japanese breeds which he studied in Japan, and afterwards reared and crossed for several years at the Gorizia Experiment Station. Silkworms become more vigorous, not only through crossing, but also by change of country. The author fround, both in China and Japan, breeds that were much prized, though they had the defect of great susceptibility to " flacherie ", which on being brought to Europe, proved most resistant to that disease. The same fact has been observed in Europe; some regions even, especially the districts of Ascoli and the Abruzzi in Italy, and of the Var and Basses-Alpes in France, have a good reputation for the production of vigorous native breeds of silkworms, which when reared in other countries, are much less attacked by the malady.

1038 - **Silkworms Mounting on Broom.** — FAVERO, P., in the *Bollettino del Consiglio provinciale d'Agricoltura*, Vol. XXXIV, No. 10. p. 189-192, figs. 2. Trent, May 30, 1921.

A mistake very frequently made by silkworm rearers is to feed the caterpillars too soon after the 4th moult, which causes them to grow unequally, and also makes them all mount on the broom as soon as the first ones are ready. In this way, some of the larvae will get on the broom after having again eaten a meal, and therefore will produce a smaller quantity of silk.

Another error consists in covering the branches with cloths, etc., so as to hinder the circulation of air, thus inducing cocoon rust or destroying the lustre of the silk.

The author therefore advises the adoption of the system used in Piedmont and the Abruzzi, which is figured in the text. At suitable intervals in the trays used for breeding, hedges or tunnels should be made of light elastic material (any dry, clean branches can be used). The silkworms which are kept thus separated, are fed uninterruptedly during the pupation period so that they go on to the broom as they become ready, which under normal conditions, means in 3 or 4 days, counting from the first caterpillar to the last. No covering of any sort is put over the branches. With this system, heavier, flawless, cocoons with a larger yield of silk are obtained, and double cocoons never occur.

FARM ENGINEERING.

1039 - **Motor Ploughing in Cyrenaica.** — GORINI, P. M., in *L'Africa Italiana*, Vol. XL, Part III, pp. 122-123. Naples, May-June 1921.

The author shows by the following data, the great advantage of hiring motor-ploughs for tilling the land in Cyrenaica.

In the plain to the south of Bengasi, the Arab, if he has no better implement at his disposal, hires a native wooden, pointed plough drawn by a camel for preparing the seed-bed. He pays for each workday a minimum of about one " measure " of wheat, or two of barley, payment being nearly always made in kind. A " measure " equals $^1/_8$ *saa*, which weighs on an average 90 kg. in the case of wheat, and 60 kg. in that of barley, It takes two days and a half to plough 1 hectare with a camel and native plough. To the cost of hire must be added other small expenses, and the camel-driver's food. Therefore, the cost of native labour for 1 hectare is nearly equal to that of a day's work with a motor-plough (reckoned by the author at 70.87 lire), and the work is not nearly so satisfactory.

Deep ploughing can be done once every 3 years, and followed by autumn harrowing in the 2 following years.

Motor-plough trials were carried out from March 4 to 6, 1921, in the Bengasi Colony at Rahba, under the auspices of the Colonial Government Agricultural Office. The " Romeo " tractor of 12-25 HP was used ; it is very well adapted to the conditions, and its work is excellent.

1040 – **Trials of Gianetti Motor Cultivators** (1) **in Capitanata, Italy.** — GRAMAZIO, I. (Direttore dell'Ufficio Agrario di Capitanata e dei Consorzi Viticoli di Foggia, San Severo, Torremaggiore), in *La Propaganda agricola*, series II, Year XIV, No. 14, pp. 194-198. Bari, July 31, 1921.

Tillage trials made with GIANNETTI motor cultivators, on the initiative of the *Ufficio Agrario di Capitanata*, in the district of Foggia, on May 30, on gravelly land covered with stubble ; on May 31, in a kitchen garden ; on June 2 and 3 on fallow land, and in vineyards, at Sansevero ; on June 7 and 8 at Cerignola, in a nursery of American vines ; on fallow land, and in a mown meadow. According to the work to be done, two machines were used, the one of 30, and the other of 6 HP.

The work taken as a whole was satisfactory, and the tests prove that the Gianetti motor cultivator is well adapted for preparing the ground for sowing, especially for the secondary operations, for it breaks up the stubble, even in gravelly soil, and eradicates the weeds.

On fallow land, the width of ground worked by the large model is 1.10 m., and it will penetrate to a depth of 20 cm. (the depth can equally well be fixed at 10, or at 28 cm.) ; it works 800 sq. metres an hour, consuming 5 litres of benzine. In kitchen-gardens planted with trees, the width of ground worked by the small model was 60-70 cm., and the depth penetrated was 8-15 cm. ; it worked 870 sq. metres an hour, consuming 2.5 litres of benzine. In vineyards, this model can work nearly 0.6 hectares daily to a depth of 8-18 cm., the cost per day being only 120 lire.

1041 – **The Couten Watering Appliance.** — *Génie rural*, Year 12, No. 107, pp. 17-19, figs. 2. Paris, February-March 1921.

The COUTEN watering appliance, shown in plan in the appended figure, is based on the principle of the tourniquet, or water drum.

This apparatus consists of a small drum that waters a radius of 6 metres, and actuates, by means of two toothed wheels, and two endless screws, another larger drum furnished with short arms. Owing to the reducing action of gearing the large drum only makes one revolution a minute. This reduction in speed permits the maximum projection allowed by the resistance of the air, so that the 4 arms of the large drum (as the diameter of each is different), represent the work of 4 men revolving slowly on themselves, and each watering a given perimeter. In this way, the watering is done perfectly regularly from the centre to the periphery, a result almost impossible to attain with a watering-can or hose. With a pressure of 1.5 kg. to 3.5 kg., a diameter of 20 to 40 metres can be watered (1200 square metres).

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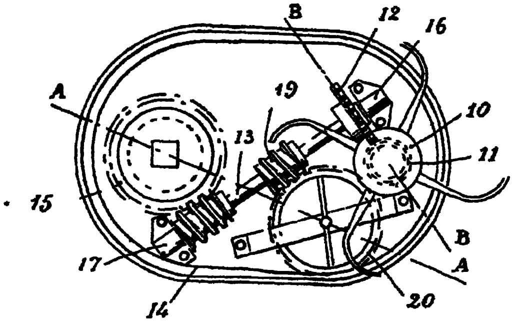
(1) See *R.* July-Sept. 1919, No. 970, (*Ed.*)

With water under a pressure of not less than 1500 gm. it is possible to water a garden in these different ways :—

1) By means of a sprayer on a tripod connected by tubing or a water-tap. This is very easily moved, as soon as one part of the ground is sufficiently watered.

2) By means of sprayers fixed on vertical iron pipes connected with a system of pipes that can be worked in succession, or in series of sprayers fixed on the same line of pipes.

3) In order to avoid the need for a man to open each set of pipes one after the other, a special patent arrangement makes it sufficient for the first tap to be opened. Then in succession, and alternately, all the taps open and close at the right moment. Thus it is possible, without manual labour, to water any extent of ground, and to give each part the amount of water it needs.



Plan of Couten Sprayer

4) It is also possible to use a motor-pump on a wheel-barrow, which sets in motion 3 sprayers simultaneously.

In order to water crops with this apparatus it is necessary to :—

1) Lay down 80 to 100 mm. cast-iron pipes in parallel, 150 metres apart.

2) Have water-cocks every 25 metres along the pipes.

3) Have 2 or 3 movable tubes, that can be attached to the fixed pipes, each supplying a certain number of sprayers. Each of the sprayers gives out, by means of its interchangeable arms, 5 000 to 10 000 litres per hour. The movable tubes of rubber, leather or canvas, are wound round a reel that can easily be worked by two men. While one set of tubes is in use, another set is being rolled up. In this way, 2 men are able to water 4 to 5 hectares a day.

Agriculturists having tractors at their disposal, can use their motor to work a powerful pump, and water a very large area automatically.

[1041]

1042 - **Martinotti Apparatus for Preparing and Bottling Sparkling Wines.** — MARTINOTTI, F. (Stazione enologica di Asti), in the *Giornale Vinicolo Italiano*, Year 47, No. 28, pp. 273-276, 1 fig.; No. 29, pp. 282-285, 1 fig.; No. 30, pp 292-294, 1 fig. Casale Monferrato, July 10, 17 and 24, 1921.

I. APPARATUS FOR FERMENTING SPARKLING WINES IN AN AUTOCLAVE. — The object of the apparatus described by the author is to make wines effervesce in a short time (a few months) by means of fermentation, and thus to supersede the old classical champagne system of keeping the wine on stands and afterwards stirring and drawing it off, which required 2 or 3 years. The wines to be treated must have quite settled, and finished.

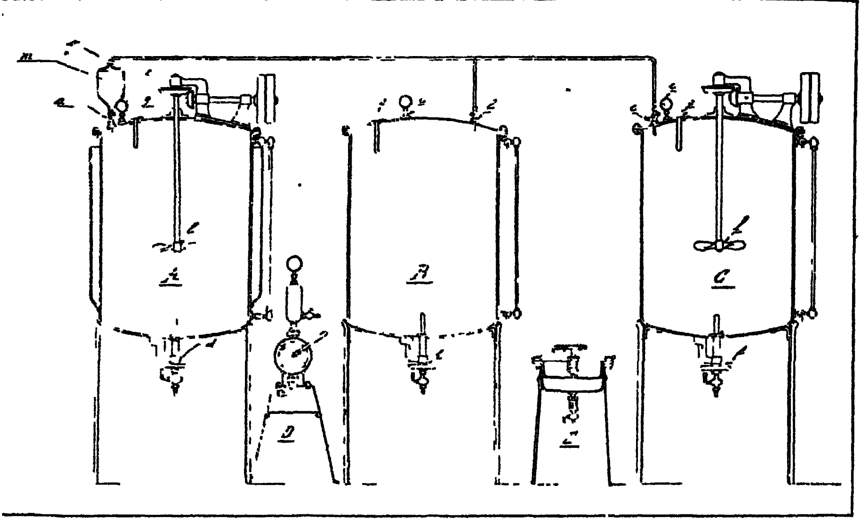


Fig. 1. — MARTINOTTI Apparatus for the Autoclave Fermentation of Sparkling Wines. Vertical Section.

The apparatus (fig. 1) consists essentially of 3 enamelled-iron autoclaves, A B C, of the same capacity, and able to resist the pressure of 8 atmospheres (in the figure, for the sake of clearness, the pump and the filter are drawn on a larger scale than the autoclaves).

Autoclave A, in which the fermentation takes place, is put in surroundings favourable to the process, while autoclaves B and C, which are intended respectively for clarification and to receive the filtered wine, are put into a properly cooled room, in order that the clarifying and bottling may take place under the best conditions.

Autoclave A is surrounded by a vessel in which circulates a freezing mixture for cooling down the wine after fermentation; further, the screw l keeps the ferments in the wine in continual suspension, in order to hasten fermentation.

The 3 autoclaves are all fitted with an attachment on the cover, to contain the thermometer to show the temperature of the wine; at the bottom of each autoclave, is a movable tube furnished with a tap that allows the wine to be drawn off from above the sediment.

The screw of the autoclave C serves to mix the mass with the liquid and the metasulphite solution, unless it is thought best to add the latter to the wine before bottling.

Pump D has a float, and is provided with a rather large air-chamber and a manometer.

The filter E is made of cellulose.

The *manufacturing process* is as follows:— The wine is brought to a temperature known to be favourable for inducing satisfactory fermentation, good ferments are added, as well as the amount of sugar necessary to obtain the required amount of effervescence. Then the wine is put into autoclave A, care being taken to maintain the temperature required, and to set the screw revolving slowly, but continuously. When fermentation has taken place, the motion of the screw is accelerated, so that the wine circulates round the sides more rapidly, then the freezing-mixture in the jacket is made to circulate in order to bring the wine almost to the freezing point. When cooled down to this extent, the wine is left to settle, should it be a little turbid, and as soon as it is clear, it is passed into autoclave C.

The operations are carried out in the following manner:— The pressure in autoclave C is regulated so as to be equal to that in A, then the two autoclaves are put into communication by means of a pipe placed above them, the taps a and c being opened. After regulating the tube to touch the surface of the deposit in autoclave A, the pump D is fitted on the one hand to the tap d and on the other, to the lower tap of the filter E, the upper tap of this filter being attached to tap f of the autoclave C. When f is opened, the pressure in the whole apparatus, autoclaves, filter and pump is the same.

Then tap d of autoclave A is opened, and the pump set going, care being taken to ensure that the manometer in the air-chamber swings slightly, and registers a pressure about 0.4 of an atmosphere higher than that in the autoclaves, this being necessary to make the wine pass through the cellulose layer.

If the wine is turbid it is clarified with gelatin, which is dissolved in the amount of hot water required, and poured into the copper receptacle m. The tube communicating with the other autoclaves is unscrewed from o, and another tube is screwed on which communicates with a cylinder of carbon dioxide; a pressure not exceeding that in the autoclave *A* is then produced in m.

The tap A is opened to allow the gelatin to pass gradually down into the wine, the screw I being made to revolve a little faster to mix the contents thoroughly. The wine is then pumped into the autoclave B, without filtering, operating in the manner described above if the wine is slightly turbid. In B, the wine clears, and as soon as this operation is finished, the lower tube maintaining the level is raised above the deposit and the wine is made to pass through the filter E into the autoclave C, from which it goes into the bottles. As fermentation lasts about 15 days, and clarification about 4 days, it is possible to have 2 to 3 autoclaves for fermentation, and a single one for clarification; in this way, the output of the apparatus is increased.

Autoclave C can be dispensed with if the filter is made to work by difference of level. Then the wine passes from the filter into a small tank, and thence through a coil of cooling pipes to the bottling-machine.

II. APPARATUS FOR INTRODUCING THE GAS INTO EFFERVESCING WINES. — As in wines which effervesce through gas artificially introduced, the bubbles are larger and the effervescence less persistent than in naturally sparkling types, the author set himself the task of selecting an apparatus to introduce the carbon dioxide in the maximum degree of subdivision, so as better to imitate its action when present in a nascent condition in naturally effervescent wines; for this purpose, he chose the CHAMBERLAND filter.

Already twenty years ago, Dr. CARPENÈ (*Giornale vinicolo italiano*, No. 4, 1901) suggested the use of porous cells for the carbonification of wines, but he subsequently abandoned this idea, and used canvas tubes as being more practical He noticed that the smaller the pores of the BERKEFELD and CHAMBERLAND filters (1) which were immersed in the wine and filled with carbonic acid, the smaller were the bubbles formed in the wine.

As the solubility of carbonic acid in wine is greater the lower the temperature, the author has tried to obtain the maximum subdivision in wine kept at the lowest possible temperature.

Description of the apparatus. — This (fig. 2) consists of an autoclave A, made of enamelled iron, or tinned copper, a compresser B, a pressure reservoir C, and a receptacle D for the gas under reduced pressure. It is provided with a cylinder of carbon dioxide E, a reduction valve G., a glass observation bottle H, and a receptacle F, in which the gas is purified.

Around the inner walls of the autoclave are carried one or more coils a-a-a of tinned copper tubing to which are hermetically screwed BERKEFELD and CHAMBERLAND filters with heads of tinned-copper. The filters, as is shown in the left-hand figure, are arranged like the spokes of a wheel, and placed horizontally, for the purpose of presenting the largest contact surface to the wine that ascends from below on account of the motion imparted to the mass by the screw B. These filters are fixed in a circle so as to be on the same vertical plane, in order that the wine that has touched a CHAMBERLAND filter may not come in contact with it at a higher level.

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(1) CHAMBERLAND filters are marked from A to F, the latter being the most porous BERKEFELD filters are more porous than F CHAMBERLAND filters. For large apparatus, special porous cells can be made. CHAMBERLAND filters are 20 cm. long, with a diameter of 3.5 cm. The length of BERKEFELD filters is 25 cm., and their diameter 4.5 cm. (*Ed*)

In the cover of the autoclave **A**, is a closed tube **k** containing a thermometer showing the temperature of the wine, a manometer, and several taps The autoclave is sorrounded by a jacket in which is a freezing solution supplied by the taps **u** and **d**.

As the compresser **B**, in order to work regularly, must be supplied with gas at zero atmospheric pressure, it was necessary to interpose the reservoir **D**, in which the pressure of the gas coming from the autoclave is reduced because the power of the compresser is greater than the amount of gas coming out of **W**.

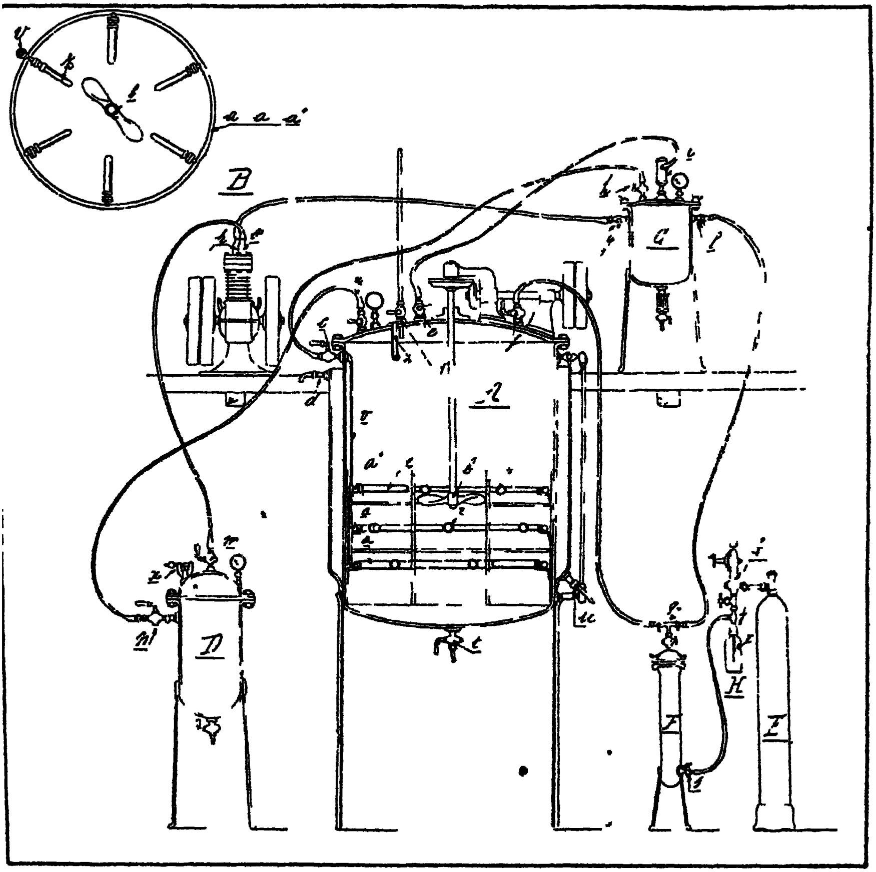

Fig 2 — Martinotti Apparatus for Introducing Gas into Effervescent Wines.

Since the compresser heats the gas in compressing it, the gas is cooled before passing into the reservoir **C**, by traversing a coil (not shown in the figure), immersed in water and ice

The pressure reservoir C protects the filters from the blows of the ram of the compresser, and prevents any drops of oil that may be projected with the gas from getting into them. On the cover of the reservoir, there are a manometer and a spiral safety valve enclosed in a case I; the safety-valve is so arranged that there is never such a pressure in the filters as to prevent their regular working.

On leaving the safety-valve the gas is admitted into the autoclave by the tap e.

Working of the apparatus. — The required pressure is first brought to bear upon the CHAMBERLAND filters by putting into action the carbon-dioxide valve and opening the taps g, l, h, c. Then tap c is opened by unscrewing the cover; subsequently tap y is opened, and through it, either by means of a pressure pump, or by some other arrangement, the wine is let into the autoclave A until it flows, mixed with gas, out of tap e. In this way, it can be secured that all the air has been driven out of the autoclave. Then the tap is turned, the cap of the tube coming from i is screwed on again, tap t is opened, and the wine rises to the right level. The screw is made to revolve so as to increase the pressure to the necessary amount inside the autoclave.

Tap W is then opened to allow sufficient gas under the determined pressure to supply the filters, that is to say, until the manometer of the autoclave A indicates no further reduction of pressure. When this point is reached, tap f of autoclave A is opened, the reduction valve G is adjusted, so as to maintain the required pressure. The glass observation bottle along the tubes h-c and w-n enables the observer to estimate the amount of gas passing through, and test the regular working of the apparatus. The compresser continues to work, and the gas goes on circulating through the mass owing to the action of the CHAMBERLAND filters, until the wine, being quite saturated, absorbs no more gas, and it can be seen through the observation bottle H, that no more carbon dioxide is passing. Then the bottling operation can be begun by turning tap t.

If it is desired to impart continuous action to the apparatus the mass is saturated in the way described above; then, while the autoclave is supplied by tap y in such a manner that the level remains constant, bottling is begun by opening tap t, care being taken not to remove, during the time required for complete saturation, more than $^4/_5$ of the wine in the autoclave. The introduction of carbon dioxide should never be uninterrupted, in order that no diminution of pressure may be caused.

In the case of ordinary or continuous work, alike, the pressure on the CHAMBERLAND filters may only be reduced when, at the close of the operations, there is no more wine in the autoclave, for wine must not be allowed to enter these filters.

The experiments made by the author were carried out under a pressure of 3 atmospheres, the temperature of the wine being —4° C, which corresponds to about 6 atmospheres at 15° C with BERKEFELD filters and CHAMBERLAND filters (*B*). The first work under a pressure of 1 atmosphere, and the second under a pressure of 3 atmospheres. Thus in the reservoir C, there were, respectively, 4 and 6 atmospheres. The safety-valve **i** was set for ¼ atmosphere more.

Advantages of the apparatus. — According to the author, these may be summarised as follows:—

1) The possibility of driving all the air out of the apparatus, for air, as is well-known, is very injurious to the quality of the effervescence.

2) The saturation of the wine at a temperature near freezing point.

3) Maximum speed of introduction of CO_2 by the use of the right number of CHAMBERLAND filters, which are indestructible.

4) The certainty that the wine is saturated with carbonic acid.

5) Possibility of obtaining a wine with sparkling properties resembling in their excellence and persistence that of natural sparkling wines.

6) The maximum facility and rapidity of bottling, since the low temperature allows of the work being done under the pressure of 3 atmospheres.

7) The apparatus takes little room, and is inexpensive.

III. APPARATUS FOR BOTTLING AND CORKING EFFERVESCING WINES UNDER PRESSURE. — With the present machines used for these purposes, it is impossible to clean the lower part of the cork before putting it into the neck of the bottle, so that pieces of cork on other substances are liable to be introduced into the wine. Further, when the ordinary corks (which have a diameter of about 35 mm.), used for exported wines are employed, these machines are not able to compress them to the required size, or if they succeed, the corks become broken and damaged in the process. In order to overcome these difficulties, the author has had the happy idea of adapting to the corking-machine the apparatus for bottling effervescing wines under pressure.

For this reason, the ramming machine has been altered in such a way, that its jaws on closing, form a cylindrical space of 15 mm., instead of a conical one. The cork must be at once reduced to this diameter throughout its entire length, because the ordinary diameter of the piston, 22 mm., has had to be reduced to 15 mm., in order to permit of its passing through the aperture of the ring placed beneath it, which at this diameter and place, corresponds to the space inside the bottle. In order to overcome the necessarily great resistance encountered in tightening the jaws, the shaft of the lever working them is longer than in the ordinary type of machine.

Beneath the opening formed by the jaws, there is a movable ring worked by the arm **a** (fig. 3) which also has in the centre an aperture **d**; this in its normal position, communicates with the cylindrical space formed by the jaws.

Into this central aperture of the ring open two other holes, made in its thickness. The wine passes through the one, and the gas through the other. Two tubes, each with a tap **b** and **c**, are screwed into these two holes on the outside.

The central part of the ring is provided on its lower surface with a rubber covering against which the edge of the bottle neck presses, this hermetically closes the bottle when the latter is pushed into place by a special eccentric apparatus worked by a lever with rack and pinion o.

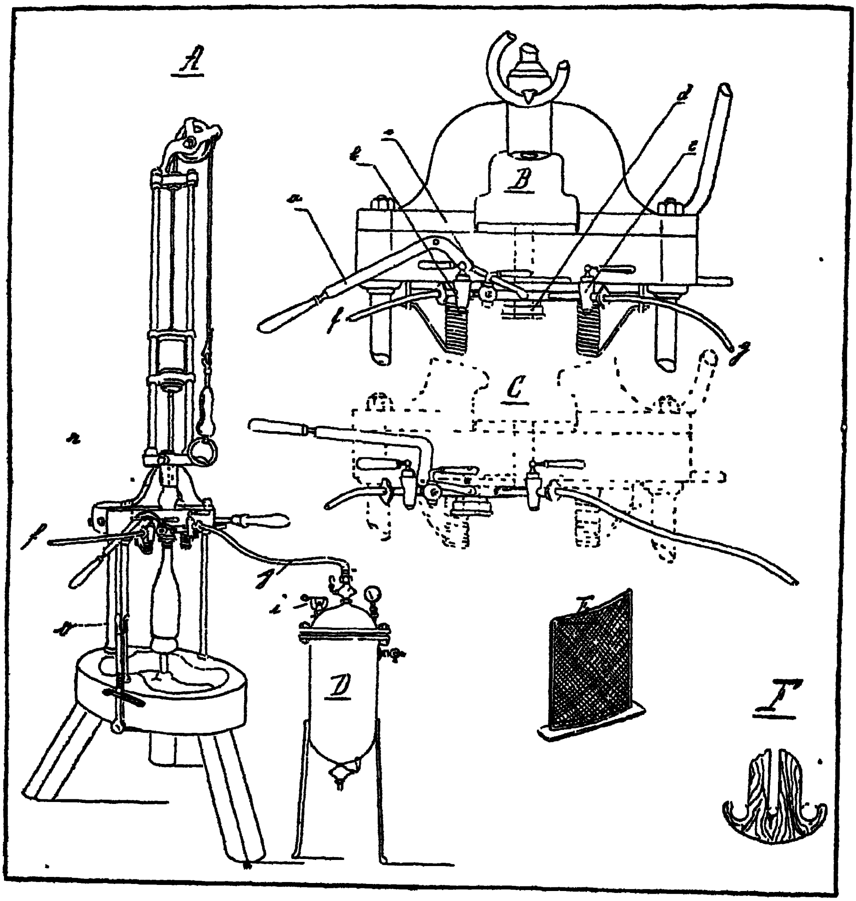

Fig. 3. — MARTINOTTI Apparatus for Bottling Effervescent Wines under Pressure.

The bottling operations are carried out as follows. The ring is placed in the position indicated by figure C (fig 3):

a) The cork is put between the jaws of the bottle-corker and pressed tight. By means of the ram, the cork is pushed in, until it just touches the lower part of the jaws; this is effected by interposing at n a piece of hard wood of the required thickness and shaped like figure F. When this has been done, the lower surface of the cork is wiped over with a sponge.

b) By means of the lever **a**, the ring is pushed into its normal position, as shown in fig. **B**, and by means of the lever **o** working the eccentric, the bottle is pressed against the indiarubber covering.

c) The thickness of the piece of wood at **n** is altered, and with a blow from the rammer, the cork is driven into the aperture of the ring in such a way as not to stop up the 2 holes through which the wine and gas pass. By means of the ring, the bottle thus remains in uninterrupted communication with the receptacles containing the wine and the gas.

d) The screen **E** is put in front of the bottle; the tap is opened through which comes the gas producing the required pressure in the bottle. This gas leaves the reservoir **D**, where it is under a pressure of about $^2/_{10}$ of an atmosphere less than the pressure upon the wine.

e) The wine tap **b** is opened, and the wine, owing to the higher excess can pass out through the safety-valve **i**, which is regulated to allow it to escape (1).

f) When the bottle is full (2), a thinner piece of wood is interposed at *n*, and with a blow from the rammer, the cork is driven into the bottle to the required distance, then after having removed, by means of the lever, the eccentric compressing the bottle and the last shaving of wood regulating the descent of the rammer, the cork is driven entirely through the aperture of the ring by a blow from the rammer, and the bottle is removed in this way, being no longer supported by the spring found at the bottom of all corking-machines of this type.

g) The cork is wired on to the bottle by means of the usual appliances.

How far the cork should be inserted into the neck of the bottle, depends upon whether it is coated with paraffin or not. Paraffined corks must be pushed in further than unparaffined ones, to prevent them from flying before they can be wired down.

To prepare the paraffin, some benzine is taken to which 10 % of paraffin is added and the mixture is warmed until the paraffin melts; the corks are dipped into it, and quickly withdrawn, being then exposed to the air until all the benzine is evaporated.

In order to impart the necessary elasticity to the corks, they are exposed to the action of steam for some time before use. This, together with the paraffin covering them, greatly facilitates the corking operation.

By decreasing the pressure in the vessel **D**, at the right time, it is possible to cork bottles, even if the wine comes from apparatus placed at a lower level than that of the corking-machine.

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(1) This arrangement prevents the air in the bottle from entering the gas-supplying apparatus, which would interfere with the effervescence and prevent the wine keeping.

(2) Tap **C** is to carry off the wine from the bottles, if they are too full. (*Author's notes*)

[1042]

1043 - **The Suvino Rice Drier** (1). — TARCHETTI, A., in the *Giornale di Risicoltura della R. Stazione sperimentale di Risicoltura e delle coltivazioni irrigue*, Vol XI, No 6, pp. 83-91, figs 6. Vercelli, June 30, 1921.

The author gives a detailed description of the different parts of this apparatus, which works as follows :—

The paddy to be dried is poured into a hopper, whence it is raised by an elevator, and discharged into the drying chamber, where it falls on a sheet-iron apron placed over the drying chamber, and having a slight oscillating motion. The paddy is thus uniformly and automatically distributed in the chamber. It falls from the top of the chamber and finds its way out at the bottom by means of three hoppers with spouts, from which the rice falls upon an oscillating sieve, that frees it from soil, seeds, stones, etc. ; it then passes before the pipe of a fan where it is further cleaned, all the glumes and light substances being removed, and finally falls into the hopper of a second elevator which carries it to the storehouse.

The course of the drying air is as follows :— At the back of the drying-chamber there is a hot-air store, bearing two fans on the bottom and sides ; these suck in the surrounding air at the height of the store, obliging it to pass along the heating pipes into a collecting chamber, and then, after it has passed through all the mass of paddy to be dried, carry it into another chamber, where the pressure is kept below that of the atmosphere by means of an aspirator, which absorbs the damp air and drives it outside.

AGRICULTURAL INDUSTRIES

1044 - **The Industrial Manufacture of Alcohol From Carobs.** — MEZZADROLI, G. (Vice-Direttore della R. Stazione sperimentale di Bieticoltura, Rovigo), in the *Bollettino dell'Associazione Italiana delle Industrie dello zucchero e dell'alcool*, Year XIV, No. 3, pp. 53-61. Bologna, June 1921.

The object of this article is to inform practical distillers how carobs (which are difficult to ferment) should be treated in order to obtain alcohol from them. The author therefore describes the plant and the work done at the distillery of MONACO and son of Catania by G. VINCENTI (engineer) of Rome in collaboration with the author, who attended to the chemical side of the operations.

The carobs are carried by an elevator into a disintegrator with double cones, and provided with knives that cut up the pods, while leaving the seeds intact ; the latter are then separated by a sifter and put into a sack ; the remains of the pods pass into the extracting apparatus. The latter consists of 10 extractors, each containing about 100 hectolitres, and furnished at the bottom with a filter that catches the solid particles, but allows the sweet juice to pass from one receptacle to the other.

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(1) Constructed by F. SUVINO and Co. at Mortara. For a detailed description of rice-driers see. Ing. V. MARAGHINI, *Gli essiccatoi da riso ed i concorsi internazionali di Vercelli*, Milan, Soc. Ed. Libr. 1914. (*Ed.*)

Each extractor has a juice-heater, and a set of circulation pipes through which, owing to the difference of level, the water and the juice pass from one vessel to another.

From 30 to 40 quintals of the triturated carobs are put into each extractor ; the extraction takes place at from 95°-105° C. As a rule, the operation is carried on, at a high temperature, to 15-20° Brix, which reppresent about 20 % of sugar. An extractor only needs filling every 20-24 hours. The extracted carobs contain scarcely 0.30 % of sugar (their original sugar content was 40 %). The extracted juice passes into 2 measured vessels and thence into 2 other receptacles situated in the highest part of the building. One of these receptacles is provided with means for providing complete aeration and inducing certain oils present in the carobs to rise to the surface ; in the second is effected the slight sulphiting necessary to correct the natural acidity of the pods ; this process also serves to remove the butyric forms, frequently present in carob musts.

From the sulphiting receptacle, the juice descends through a copper refrigerating tube to the fermentation chamber where it reaches 22° C In the fermentation chamber, there are 2 small machines for the preparation of yeast, each with a capacity of 100 litres, 2 copper vessels each holding 10 hectolitres, 3 intermediate vessels of 10 hectolitres each, and 6 large receptacles, each holding 320 hectolitres, in which the actual fermentation process takes place.

In order to start fermentation, a few flasks of must similar to that to be used in the fermentation-chamber are prepared and sown with pure selected cultures of suitable ferments (the author employed his 120-2 and M N.) When the culture has developed well in the balls, some 70 litres of the same must are prepared in the two little yeast receptacles, the ferments on the culture balls are transplanted into this, and left to develop, for which 24 hours is usually enough. On the following day, 9 hectolitres of boiled must cooled down to 30° C. are put into the two receptacles, and sown with the contents of a small vessel, the mass then being aerated with sterilised, or filtered, air. When it has reached 7°-9° Brix, the ferment is allowed to pass from the small receptacles into those of intermediate size, and continually supplied with must out of the extractors. As soon as the intermediate receptacles are also full, the volume is reduced to one half by letting the must at the bottom pass into a large vessel, and the intermediate receptacles are refilled with juice from the extractors.

The rapid growth of the ferment takes place in these intermediate receptacles, for which reason they are well aerated and given plenty of phospho-nitrogenous matter, to which are added special zymogenetic salts for the purpose of keeping the ferment always active and pure. The large receptacles are never aerated, but are supplied with nutrient substances until full, when they are left to themselves. For the complete filling and fermentation of a receptacle, 32-36 hours are normally required. As soon as the fermentation process is finished, the receptacle and its contents are sent to be distilled. The stills used are composed of ordinary BARBET continuous columns and a rectification column.

Industrial distillation yields 5 to 10 %, or an average of 8 % of alcool di testa (product of first distillation); 82 to 92 %, or an average of 87 %, of alcool di buon gusto (product of second distillation); 3 to 8 %, or an average of 5 % of alcool di coda (product of third distillation).

According to the quality of the carobs and their sugar content, 18 to 25 litres of alcohol can be obtained from a quintal of pods. Carobs with a total sugar content of 40 % will yield with proper treatment from 22 to 24 litres of alcohol.

The daily output of the distillery described is 70 hectanhydres with a fermentation chamber a with capacity. of 1800 hectolitres. The seeds are collected (being used abroad for making gum, paints, and a substitute for coffee), as well as tannic acid, the residue (which is dried and employed as a fuel), and carbon dioxide (given off from the fermentation receptacles), which is purified and compressed.

1045 - **Sugar and Alcohol from the Agave: Electrical Process of Juice Clarification.** — DELAFOND, E., in *The Louisiana Planter and Sugar Manufacturer*, Vol. LXVI, No. 25 p. 395. New Orleans, June 18, 1921, and in *Facts About Sugar*, Vol. XII, No. 25, p 491. New York. June 18, 1921.

Sugar of an excellent quality has been produced from the juice of the agave, and DELAFOND who has patented in all the sugar countries in the world, a process of electric treatment for the clarification of the juice of sugar canes, sugar beets and sorghum, etc. has now successfully applied this process to the juice of the agave, and has obtained some very fine sugar perfectly crystallised. Without clarification this juice is not fermentable, and the failure hitherto in the attempt to utilise the by-products of the henequin industry was due to the difficulty in fermentation of the juices. The author, however, expresses the opinion that by the use of the electrical clarification process a great alcohol industry can be established, and as it seems likely that in the future alcohol will be utilised to a large extent as fuel (1), this industry is of increasing importance.

Besides sugar and alcohol, various other useful products can be obtained from the residues now discarded in the process of henequin production among them being potash, phosphoric acid, paper pulp and glue.

1046 - **Contribution to the Study of Grape-Pip Oils.** — ANDRÉ, E., in the *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 21, pp. 1296-1298. Paris, May 23, 1921.

The data on the composition of grape-pip oil are fairly numerous but they vary so much, as to be almost contradictory. With a view to solving the question, if possible, the author examined 11 different samples of this oil, and obtained the results of which the extremes are given in the following Table. He shows (thereby confirming all the data previously published) that no limit can be fixed for the chemical and physical constants of grape-pip oils. This is not extraordinary, when it is remembered that the varieties of *Vitis vinifera* are very numerous, and have been fixed so long as to render it probable that the oils obtained from their seeds would be very different in character.

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(1) See *R.* July 1921, No. 764 (*Ed*)

Extreme values of the physical and chemical constants of some samples of grape-pip oils.

Density	0.9103 — 0.9334
Refractive index	1.4708 — 1.4772
Saponification index	171.0 — 191.1
Iodine index (Hanus)	94.3 — 135.0
Saponification index of the acetylated oil	189.7 — 231.8
Acetyl index	13.3 — 49.3

1047 - **Utilisation of the Potato as Stock Feed, Source of Alcohol etc, Manufacture of Dehydrated and Dried Pressed Potatoes, Flour and Starch.** — Gore, H. C. (Bureau of Chemistry, U. S. Dept. of Agriculture), in *State of New Jersey, Department of Agriculture, Bulletin* No 28 (Report of Proceedings of the State Potato Association and the State Alfalfa Association). Trenton, N. J. March 1921.

The necessity of providing some outlet for surplus potatoes during exceptionally favourable seasons, has led to the utilisation of potatoes for various purposes. The author here reports the progress made in the United States in this respect:—

Stock feed. — One of the difficulties of profitable feeding of potatoes is the necessity of providing an adequate supply of sound stock throughout a long period. It now seems probable, however, that this difficulty can be overcome by the practice of ensiling; potato silage is eaten freely by cattle and can be used also for pigs; it appears to be as palatable as the best maize silage.

An experiment was made at the Dairy Farm at Beltsville comparing the gain in weight of 6 cows, 3 fed with potato silage and 3 with maize silage for 30 days, at the end of which time the rations were reversed, allowing 10 days to make the changes and extending the length of the experiment another 30 days. The following table shows the milk and fat produced, feed consumed and the gains in weight:

Manufacture of dehydrated potatoes. — There is at present no wide market for dehydrate potatoes ed (dried) although during the war the use was considerable.

Manufacture of dried pressed potatoes. — The equipment needed for converting the potatoes into dry feed is easily constructed; the washing is done in a continuous paddle machine of the type used in washing potatoes for starch making. from the washer the potatoes are ground until liquefied and passed into a stock box, provided with a gate valve, and then passed into the hydraulic press as needed. About 1 ton of ground potato is pressed at one time, the process taking from 15 to 20 minutes. The yield of dried pressed potato is about 20 % of the weight of potatoes.

		Produce		Feed consumed				Gain in weight
		Milk lb	Fat lb	Grain lb	Hay lb	Potato lb	Maize silage lb	lb
Maize silage groups	First 30 days	1 719.3	79.95	780	540	—	2 700	60
	Second 30 days	1 611.5	83.62	810	540	—	3 000	78
	Total	**3 330.8**	**163.57**	**1 590**	**1 080**	—	**5 700**	**138**
Potato silage groups	First 30 days	1 546.0	77.64	808	540	3 000	—	86
	Second 30 days	1 732.2	80 09	780	540	2 700	—	71
	Total	**3 269.2**	**157.73**	**1 588**	**1 080**	2 700	—	**157**

MANUFACTURE OF ALCOHOL. — The work carried on under the direction of WILEY (*Bureau of Chemistry*) U. S.), started in 1910, permits the following estimates to be made as to the cost of alcohol manufacture in small plants: Approximately 0.66 gall. of 180 proof alcohol can be produced from 1 bus. of potatoes of 14 % starch content. The potatoes used daily will weigh about 8000 lb. to obtain 100 gall. per day; and this necessitates the mashing of 320 lb. of malt.

A summary of the cost per gall. of alcohol (180 proof.) is given as follows (in dollars): Raw material 0.279, investment 0.124, operating 0.159. Total $0.562.

There will be about 1000 gall. of spent mash worth $0.04 per bus. of original potatoes, or $5.33 or 0.053 per gall. of alcohol produced; this makes on an average the net cost per gall. $0.509.

This may be compared with the cost of manufacturing alcohol from potatoes in a plant of German manufacture, in which alcohol of 180 proof is produced at the rate of 263 gall. per day, and the total cost amounts to $0.478 (i. e. the net cost per gall. $0.425).

Owing to present conditions these figures would now be considerably increased, and whether or not the production cost can be decreased still remains an open question for further experimentation.

Potato flour. — The most important process developed is a steam drying method in which the potatoes are converted into potato flakes which are later milled into flour.

The raw potatoes are washed in a machine commonly used in distilleries or starch factories and then conveyed by an elevator to a steamer erected over the drying apparatus, where they are cooked by means of low pressure steam. After steaming, the potatoes are allowed to fall by gravity into hoppers and through the emasculators, where they are reduced to pulp, and in this shape are forced on to the drying drum. These drums turn in opposite directions at 5 revolutions per minute. The heat dries off the moisture of the pulp and leaves a firm mass that is scraped off by means of knives set parallel to the main axes of the drums. The dried mass falls into a spiral transformer fitted with revolving arms where it is broken into flakes and conveyed to the pracking room. Numerous factories are now established in various American States, and the capacity of a single unit plant is about 8000 lb. per day. The flour is used principally to improve the quality of bread, but has other baking uses. There is, however, still much to be done in developing this industry. The price at present is about 9 cents per lb. in wholesale quantities. The author considers that this flour does not possess the same glutinous quality as rye and wheat flour, but has peculiar properties as yeast food and a good flavour.

Potato starch. — This is more extensively manufactured than any other potato product. All grades of potatoes have been found to yield starch of good quality. The author describes the methods employed in the American factories including the processes of washing, grinding, sieving, settling and washing the starch, the treatment of "brown starch" (soft layer of sticky brownish sludge 2 to 6 in., in thickness, consisting of fine particles of cell-wall tissue from the potatoes and other impurities and a certain quantity of starch), and finally, the drying and bagging. The average capacity of the starch factory with its dryer is 4 tons of dry starch per day.

The author considers the "JONES" factory at Caiibon, Maine, as an example of the best type of the more modern Maine potato starch factories. It differs from the earlier types in the arrangement and operation of the settling and washing tanks.

As regards the value of potato starch compared with other starches, the author states that it is more valuable than maize and cassava starch, but somewhat inferior to wheat starch. The actual starch content amounts on an average to 15 %.

It has, however, value in the finishing and weaving of textiles which no other product possesses, especially fine grade cotton goods. It is also the source of the best grade of white dextrin used in making finer grades of library paste.

1048 - **Experiments in Drying Green Peas.** — MESSINA, M., in the *Rivista di Agricoltura*, Vol. XXVI, No. 27, pp. 384-386; No. 28, pp 396-398. Parma, July 8 and 15, 1921.

Peas that have been dried when quite ripe, that is to say, when they have turned yellow, are little in demand, in the first place, because they are indigestible, and in the second, because they are often attacked by *Bruchus pisi*.

If, however, peas are dried while still green and immature, they are most digestible and nutritious, and still retain to a great extent their original flavour and tenderness. According to analyses made by PAYEN, the percentage composition of dried yellow and green peas respectively is as follows:— Starch, dextrine and sugars 58.7 and 53.5 %; nitrogenous matter 23.8 and 25.4 %; fats 2.1 and 2.0 %, crude protein 3.5 and 1.9 %; salts 2.1 and 2.5 %; hygroscopic water 8.3 and 9.7 %. For removing the peas from the pods, the author recommends the Navarro sheller with which he obtained the following returns:— From 100 kg. of unripe pods, 22-24 kg. of peas; from 100 kg. of completely ripe pods, 30-35 kg. of peas, the general average being about 30 %.

For separating peas of different sizes, the Navarro sorter gives good results, dividing the peas into 6 classes indicated by the figures 0-5; these figures give the quality;— 0-1 extra-fine; 2 very fine; 3 fine; 4 average No. 1; 5 average No. 2. The returns obtained by the author for these different qualities were: 10, 20, 40, 20, and 10 % respectively.

The peas are then scalded by immersion for 3to·4 minutes in boiling water containing 1 % of common salt, after which they are dried in the air, previous to bring put into the drier. A good apparatus for drying peas is the "Ryder" made by Messrs P. H. MAYFARTH and Co. In his experiments the author used an American drier, consisting of a wooden chamber 2 m. in length, and inclined at an angle of about 20°. In this chamber circulates the air heated in a small oven attached to the apparatus. There is an ingenious arrangement for regulating the heat of the current of air. Care must be taken to dry the peas slowly at first, and to increase desiccation gradually. The author obtained the best results by using the following temperatures; 35° C. for the first 3 hours; 40° C from the 3rd to 6th hour; 45° C from the 6th to the 10th, 50° C from the 10th to the 14th. It takes from 12 to 14 hours, according to their size, to dry the peas.

As much as 25 kg. of dried peas can sometimes be obtained from 100 kg. of fresh ones, but the usual quantity is between 20 and 22 kg.

1049 - **Larch (Venice) Turpentine from Western Larch (*Larix Occidentalis*) in the United States.** — MAHOOD, S. A. (Chemist in Forest Products), in *Journal of Forestry*, Vol. XIX, No. 3, pp. 271-282, tables 8. Washington, D. C., March 1921.

Oleoresin or Venetian turpentine has been obtained for some time past from bore-holes made in the trunk of the European larch (*Larix decidua* Mill. (= *L. europea* De Candolle) which is grown for resin producing purposes in the Tyrol, in Piedmont, and in France in the vicinity of Briançon.

Owing to the fact that during the war importation of this product States into the United practically ceased, experiments were begun by the Forest Service in 1917, to determine what were the possibilities of obtaining a similar product from western larch (*L. occidentalis*) which occurs in large stands in the Northwest. Holes were made in the trees and plugged with dry larch to prevent loss by evaporation, and the bores were made "breast high". On 3 areas on the National Forests in Montana, trees were tapped between May 22 and June 12, and collections of oleoresin were made between mid October and mid November. Single taps were made on 30 trees in each area and double taps on 20. The trees with double taps yielded on the average nearly 3 times as much oleoresin as compared with the others.

Out of the 150 trees tapped, the total number of productive taps was in 1917 and 1918 respectively, 77 and 111, and the average per tap (in ounces), 1.8 and 0.8. The average for productive taps in ounces was respectively 2 6 and 1.4.

The yields were smaller than it was hoped they would be, but it is possible that by boring the holes near the ground, selecting the most favourably located stands, and continuing the observations over a longer period, the yield of oleoresin could be materially increased. Further experiments along these lines are being contemplated.

The material sent to the Laboratory consisted of 2 distinct products, one a thin liquid and the other a thick gum. The former is apparently the sap of the tree, has a specific gravity of 1.110 at 20° C. and was shown to contain 22.1 % of ε-galactan (*Journal of Industrial and Engineering Chemistry*, Vol. 8, p. 34). This gave crystals that melted at 212° when oxidised with nitric acid. The oleoresin has the consistency of honey, is light amber in colour, slightly bitter in taste and has an agreeable terebinthic odour. The Tables show physical constants and the results of steam distillation after the material was strained through cheese cloth. The averages obtained were as follows: specific gravity 1.0054, optical rotation (20 % alcoholic solution) 24.78, volatile oil 15.8 %, resin 81.2 % moisture 2.8 %, trash 0.2 %.

The average chemical constants on the same three samples were obtained as follows: acid number 90 2, saponification number 97.6, ester number 6.4.

The oleoresin was found to contain approximately 16 % of a volatile oil consisting chiefly of α-pinene together with smaller amounts of β-pinene and α-limonene. The non-volatile portion is a resin possessing acid properties but yielding no crystalline product by the usual methods of crystallisation.

Oleoresin did not conform to some of the accepted tests for Venice turpentine. The acid value is high and the ester low as compared with the commercial standard. However, the values agree very well with the results obtained by BECKERTS and BRUCHE (1) and more nearly approach the values for the oleoresin from *L. decidua* than do the results obtained by SCHORGER on Douglas fir turpentine (Oregon fir balsam) (*Journal of American Chemical Society*, Vol. 39 (1917) p. 1040).

Unlike that from *L. decidua*, oleoresin from *L. occidentalis* does not dissolve completely in 3 pts. of 80 % alcohol, nor does its alcoholic solution remain clear when made alkaline with 10 % potassium hydroxide. On the other hand, both oleoresins possess a slight greenish fluorescence in reflected light, and neither solidifies with $^1/_{16}$ its weight of magnesium oxide.

Two properties make Venice turpentine of value for particular purposes: it does not readily become hard on exposure, and after standing, crystals do not form in it. The oleoresin from western larch possesses these properties, and tests made by a commercial firm indicate that western larch turpentine is a satisfactory material for all those industrial purposes for which Venice turpentine is ordinarily used.

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(1) Analysis of Resins, Balsams and Gum Resins DIETERICH (1901) (*Author's Note*)

1050 - **Pasteurisation of Milk in Bottles and Jars** (1). — KUFFERATH, H., in the *Annales de Gembloux*, Year XXVII, Part. 6, pp. 196-202. Brussels, June 1921.

In the course of tests carried out at the Intercommunal Laboratory at Brussels for the purpose of controlling the milk supplied by the Intercommunal Dairies, it was found to be quite impossible to pasteurise milk completely with the usual type of continual pasteurisers (the " holding process "), under normal industrial conditions, and further that from the hygienic standpoint, the results obtained were disastrous. Thus, from 1915 to 1918, 22 samples out of 29 examined were declared to be bad, and not to answer to the description of pasteurised milk ; only 4 samples were good, and 3 were fair. On an average these milks contained 349 379 bacteria per cc. and in 10 cases (or 34.4 %), coli bacilli were discovered. Until the end of 1919, out of 7 samples of pasteurised milk 1 would be found satisfactory and 6 unsatisfactory ; 4 times coli bacilli were present, and the average number of micro-organisms was 910 693.

On testing the milk on the market, this was also proved to be insufficiently pasteurised.

Subsequently, the author together with M. BOCK, carried out some pasteurisation experiments at the Boitsfort dairy. They used simplified apparatus consisting of a steam generator, and a small metal boiler heated over an open fire ; the steam was conducted by a tube to the pasteurisers, properly so-called, which were placed in another room. These consisted of simple vessels of galvanised iron with an internal diameter of about 1 metre, and a depth of 70 cm., having at the bottom, an opening for the admission of the steam, and also a waste-pipe. The experimental data that follow refer to the heating of milk in bottles and jars.

It was found that in order for the pasteurising process to be carried out satisfactorily, heating, when bottles are used, must be continued from $1\frac{1}{2}$ to $1\,{}^{3}/_{4}$ hours, counting from the first admission of the steam to the end of pasteurisation. With jars, 50 to 60 minutes is reckoned to be sufficient. The 19 samples examined all proved satisfactory, the average number of micro-organisms being 472 per cc. In no case were coli bacilli present ; the only micro-organisms discovered being spore-forming bacteria.

1051 - **Storage of Vegetables** (1). — DIFFLOTH, P., in *La Vie Agricole et Rurale* (1) Year 10, Vol. XVIII, No. 19, pp. 293-297, figs 7., bibliogr. of 4 works. Paris, May 7, 1921.

Description of the various types of cellars, caves and silos, etc., which may be employed advantageously for vegetable storage purposes, and

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(2) See : *R.* Oct. 1916, No. 1120. — For pasteurisation in general, see also *R.* 1916, Jan. No 110 ; April, No. 449 ; *R.* Mar. 1917, No. 283 ; *R.* May, 1918, No. 579 and Dec. 1918 No. 1403. (*Ed.*)

(1) Number devoted entirely to Horticulture, containing in addition to the article in question, other articles of interest concerning fruit and flowers : P. HOC, Le nitrate de soude et les cultures maraîchères. — P. DUBOIS, Trufficulture. — A. TRUELLE, La bonne tenue du fruitier. — A. ROLET, Le changement de coloris de fleurs par la culture. — P. DUBOIS, Notes de floriculture. (*Ed.*)

the treatment recommended for beans, peas, turnips, carrots, celery, potatoes, sweet potatoes, Jerusalem artichokes, and salsafy.

Cellars. — Emphasis is laid on the need of adequate ventilation, and the author suggests the placing of a bent pipe fixed into one of the windows or air-holes. Care should also be taken to prevent contact between vegetables stored and soil, in order to avoid maggot attack, etc.

Outside cellars are preferable from the point of view of temperature and air regulation; it is advised to keep the vegetables entirely apart from the fruit when in storage.

The use of cement is considered distinctly advantageous from the point of view of protection, impermeability and insect attacks. The size of a cellar lined with cement should not exceed 9.8 ft. or 11.4 ft.

Only where the weather is very severe is it necessary to construct subterranean cellars, but where mild, protection with turf or straw is sufficient, placed on planks supported by a double line of stakes. If it is fairly cold and damp it is advised to adopt the aforesaid method, but making the partition between 9.8 to 11.7 in. thick and filling the intervening space with sawdust, hay or turf.

Another type of cellar found to be useful is constructed on the semi-subterranean system with the walls only reaching up to the ground level, and only the roof being above ground.

Silos. — Careful drainage essential; the vegetables should be placed in regular layers on a bed of straw or rushes and covered with similar materials and a final outer covering of 2 to 2 $^3/_4$. in depth of soil. If the weather is exceptionally cold, a further layer of soil, straw, etc. can be added. A good thickness of straw will ensure aeration, and if necessary a triangular arrangement of wood can be made.

For winter vegetables the author advises the piling up of several species of vegetable in the same silo in order to avoid the uncovering of each silo every time in order to obtain the required vegetable. When one pile is finished, the next may be resorted to, and by following this method the constant repeated repiling of the various silos is rendered unnecessary

TREATMENT OF VARIOUS VEGETABLES. — 1. *Beans and peas.* — For runner beans and peas, the pods should be collected and placed in the sun until completely dry. Dwarf beans can be pulled up in clumps when the majority of pods have matured, these can be dried after pulling off the leaves, and then crushed with a hand beater.

2. *Beets.* — All the forms of storage pre-described are suitable to beets, but if possible the piling up in small heaps by the wall of the storehouse is preferable.

3. *Cabbages.* — Similar treatment to beets; a further method employed is the pulling up the whole plant with its roots and placing in a silo roots upward in rows of three, or placing in trenches (9.8 to 12 in. in depth) side by side, covering the roots with soil or sand; above the trench, stakes are put, 2 ft. high with soil piled up at the sides; planks are then

placed on top and covered off with a layer of straw, leaves or compost sufficient to protect the cabbages from frost.

If the tops are cut as required, leaving the roots in place, the old stumps will give new shoots the following spring which will serve as an excellent green vegetable and at a time when other fresh vegetables are rare.

It is not considered advisable to store in the house cellar owing to the strong odour which invariably accompanies storage.

Carrots. — All forms of storage are possible : the silo method is, however, the best, and as they are not easily damaged by frost, they need only be lightly covered.

Celery. — This can be preserved in its original position, and when the cold weather is approaching, it is sufficient to earth up round the plant and if necessary to add a layer of straw. Another method adopted is the digging of a trench 9.8 to 11.7 in. wide and 2 ft. deep ; the bottom of the trench should be well broken up and after earthing up the celery planted out in rows therein and watering once or twice, the trench is left open until the upper leaves start to yellow ; no watering should be done after this and when the first frosts are likely to start, it is sufficient to cover, adopting the plank system, with straw, etc. If the celery is, on the other hand, stored in a cellar etc., care should be taken to cover as much as possible with fine soil or sand.

Onions. — Onions, shallots and garlic should never be stored until quite mature and absolutely dry; sacks, boxes, barrels, etc. are suitable.

Potatoes. — Apart from the generally recognised forms of storage for potatoes, a covering of straw or compost over the piles is considered advisable. The author recommends silo storage in preference to cellar.

Sweet potatoes and Jerusalem artichokes. — Dry for some days before storing ; a dry place and a medium temperature is preferred.

Salsafy. — Similar methods as employed for beets and carrots.

Turnips. — Turnips are resistant to frost but spoilt by alternations of frost and thaw: they can be well preserved either in hemps or silos. They should not be stored in the house cellar on account of their strong odour.

1052 - **Freezing Injury to Potatoes when Undercooled.** — WRIGHT, R. C., and TAYLOR, G. F. (Office of Horticultural and Pomological Investigation), in *United States Department of Agriculture, Bulletin* No. 916, tables 8, figs. 1, pl 1, bibliogr. of 9 works. Washington, D. C., June 13, 1921.

There are 2 general classes of frost injured potatoes, those frozen solid and liable to collapse immediately on thawing, and those that show evidence of injury only on being cut open a few hours after being warmed. The first class is easily identified by the soft, wet condition that develops on thawing and is due to potatoes being subjected to freezing at very low temperatures or to prolonged exposure at higher freezing temperatures. The second class is not apparent on superficial examination, and is due to exposure to temperatures just below freezing point or to a very low temperature for a short time. If after the potato has been thawed a few hours, it is cut open, evidences of this type of freezing injury are apparent by the presence of vascular discoloration of 3 types or a combination of any of the three.

In order to apply to the handling of potatoes the knowledge of the process of undercooling and freezing already gained, a series of experiments was conducted at the Arlington cold storage plant of the Bureau of Plant Industry, U. S. Seven standard varieties of potatoes, all true to name and grown under the same conditions at the Aroostook Farm of the Maine Agricultural Experiment Station, were used; namely: Triumph, Irish Cobbler, Spaulding No. 4, American Giant, Rural New Yorker, Russet Rural and Green Mountain. They were all kept in a temperature of 40° F previous to experimental use.

At the conclusion of each test, the potatoes were removed and held at ordinary room temperature for about 24 hours before being cut longitudinally for exanimation.

Attention is called to the fact that potatoes when undercooled are liable to freeze when jarred. This is important both from the cultivators and shippers' point of view. Experiments were conducted to determine the amount and character of the disturbance necessary to cause freezing when different varieties of potatoes are held at temperatures between 28° and 25° F. The same 7 varieties were employed.

When undercooled at 28° F. dropping from a height of 2 ft. caused potatoes to bruise badly. and to show extensive freezing injury. When dropped 1 ft. they did not bruise, but showed frost injury. When dropped 6,4 or 2 in. once, no injury resulted, but when dropped 6 times frost injury followed. When wet, injury also resulted. Potatoes supporting a 100 lb. weight were not injured (a mixed lot of 12 potatoes was held at 28° F. for 72 hours while supporting a 100 lb. bag of sand no injury was apparent).

When undercooled at 28° F. and rolled across the floor for a distance of about 50 ft. in bags, freezing injury resulted; undercooled at 28° F and dropped 6,4 and 2 in. once showed signs of frosts injury After freezing commenced it was evidently progressive; the amount of injury caused within a stated time seemed to depend upon the surrounding temperature.

Immediately after inoculation the temperature of the potato rose to its true freezing point and remained for a varying length of time, depending upon the surrounding temperature.

Some varieties are apparently inoculated more easily than others, even though their freezing point is higher, Spaulding No. 4 appeared to be less injured in each case than the other varieties; Rural New Yorker and Irish Cobbler were more subject to injury.

1053 - **Storing Sweet Potatoes in Trinidad.** — BRUNTON, L. A (Assistant Superintendent, St. Augustine Experiment Station, Trinidad), in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIX, Pt. 2, p 88. Port-of-Spain, 1921.

Results of an experiment in storing sweet potatoes made last year at the Experiment Station, St. Augustine, Trinidad.

Two lots of potatoes, one of 400 lb. and one of 200 lb., were stored separately on March 6 and 11 respectively, directly after digging.

A thick bedding of thoroughly dry banana leaves, to a depth of 6 in., was spread on a flat level piece of ground; upon this the potatoes were heaped in the form of a cone, and covered with a layer of dried banana leaves 6 in. thick; finally the heap was covered with 4 in. of earth well beaten down and smoothed over. To ensure thorough drainage a trench was dug around the heap. For the purpose of ventilation a bamboo pipe was inserted in each heap to allow the escape of heated air during the first 14 days, the projecting end being fitted with a plug.

A month later both heaps were opened, but the 400 lb. layer shewed half the contents rotted (the only sound potatoes were found on the outside of the heap and these were taken and re-treated as described above, but with similar results). On the other hand, the potatoes in the 200 lb. heap opened on the same dates, were with few exceptions found to be in sound condition, and when re-opened a month later on June 12 were still in good condition, and on July 8, four months after storing, although some root growth had taken place, they were still perfectly sound, palatable, and cooked dry and floury and with an excellent flavour. The loss in weight due to drying and the few which had rotted amounted to 40% (The rainfall during this experiment did not exceed 6.42 in.).

It is therefore apparent that sweet potatoes can be stored for 4 months, *provided the heaps are moderate in size*, and the contents are kept from direct contact with the soil by a liberal covering of dry trash.

An experiment on a larger scale is in progress this year (1921).

1054 – **Some Changes in Florida Grapefruit in Storage.** – HAWKINS, L. A., and MAGNESS, J. R. (Scientific Assistant, Office of Horticultural and Pomological Investigations, Bureau of Plant Industry U. S. Dept. of Agriculture), in *Journal of Agricultural Research*, Vol XX, No. 5. tables 7, Washington, D. C, Dec. 1, 1920.

The present investigation was taken up to determine the effect of storage at various temperatures on the fruit and particularly on the sugar and acid content of the pulp, seeing that these substances constitute the major portion of the dry matter of the pulp or interior of the fruit excluding the seeds.

In the 1917-18 season experiments were made with Silver Cluster fruit part of which was stored at 86° F. and part in a commercial cold storage at 32°. The juice alone was analysed but comparative percentages of peel and pulp were determined in some cases.

In 1918-19, the Davis and "Common Florida" grapefruit varieties were employed, and cold storage temperature of 36°, 36° and 40° F. were used as well as common storage at a mean temperature of about 50° (with probable 5° fluctuations) and 2 warm storage temperatures, about 70° and 86° respectively. In most cases the fruit was weighed when placed in storage in order to determine the shrinkage.

From the results obtained it may be concluded: 1) There is a general decrease in titrable acids during storage e. g. fruit placed in storage contained on an average 1.02 to 1.28 % acids (as citric), after 60 to 62 days 0.92 to 0.96 %, after 178 to 179 days, 0.80 to 0.92 %. These were at varying temperatures of 32°, 36° and 40° F. In warm storage there appeared to be scarcely any decrease in acidity in the fruit stored in cans, i. e. unventilated packages, either at 70° F. or at 86° F. after 50 to 86 days storage.

2) There is an apparent increase in sugar content in cold storage, calculated to percentage of pulp, which seems to be due to loss of water from the fruit; the sucrose content, however, remains about the same during storage. Apparently the breaking down of the sucrose keeps on a par with the shrinkage of the fruit. The increase in total sugars, as the season advances, may be attributed to an increase in free-reducing substances. When placed in storage the sugar content averaged 4.33 to 8.96 %, and after 178 to 179 days, 4.85 to 9.84 % (temperatures as above). In warm storage it seemed probable that in these experiments there was a decrease in the sugar while the sugar content of fruit stored in unventilated packages showed always a decrease in % of total sugars present, while in ventilated storage the increase in sugar content is in no case more than sufficient to account for the probable shrinkage of the pulp.

3) Dry matter increases during storage. This is probably due to the loss of water from the fruit as well as to losses from respiratory activities, both of which are included in shrinkage.

4) Shrinkage of the fruit increases with the length of time the fruit remains in storage and is as a general rule from 5 to 8 % in cold storage to about 23 % in warm, ventilated storage.

5) Decrease in thickness of peel during cold storage is about 30 %, due probably to the loss of water; there was also a relative thinning of the peel during warm storage. An undesirable feature of cold storage is the breaking down or pitting of the peel at the temperature of 40° F. or lower; the sunken portions may coalesce making a large sunken area of dark-brown tissue, which, however, does not extend into the pulp as the flavour is unaffected; the fruit kept in a temperature of 40° was that most seriously affected, — it was less marked in 36° storage and almost unnoticeable at 32° F.

6) The flavour of the fruit improves in cold storage.

7) Fruit does not deteriorate rapidly after removal from cold storage.

8) The best storage temperature seems to be 32° F.

1055 - **Spontaneous Combustion in a Heap of Sacks.** — MEZZADROLI, G., in *L'Italia vinicola e agraria*, Vol. XI, No. 29, p. 452. Casalmonferrato, July 17, 1921.

Spontaneous combustion is known to take place in hay (1), in grass if made into heaps while still damp and in pulp of sugar factories, but for sacks thus to catch fire is a rarer occurrence.

The causes determining this combustion are the usual ones, viz., the renewed activity of the dormant enzymatic principles in the interior of the mass or heap, owing to the latter having attained a certain degree of humidity, or else the awakening of certain special micro-organisms.

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(1) See *R.* April 1921, No. 440. (*Ed.*)

The consequences of these changes are the slow rise in internal temperature of the mass, the successive growth of different microflora and a continually higher optimum temperature, until the flameless combustion of the pile of sacks is produced. The final products of this process are :— Charcoal, carbon dioxide, acetic acid, formic acid, small amounts of butyric acid, and several kinds of gas

The author records a similar occurrence that took place in a fruit distillery.

As the fruit was emptied out of the sacks, the latter were piled up just as they were, dirty and impregnated with sugary substances which would have been removed by washing, a process carried out as a rule regularly every 10 or 15 days, but which had been put off owing to press of work, so that a large heap of about 1 500 sacks had been left in a corner of the room for 20 to 35 days. When were taken the sacks for washing, it was found that the heap had become as hard as stone and black like coal. The carbonised mass which was solid and stratified, and contained the remains of the textile fibres, emitted a pungent odour ; it was so hard, that it had to be broken with a pick-axe.

Nothing remained of the sacks, but some pieces of material on the outside of the pile; these were burnt, or so much charred, as to fall to pieces when touched ; all they were fit for was to burn under the boilers.

A like misfortune occurred in a store of dried pulp at Cavanella Po (Province of Rovigo), and in Sicily where a heap of carobs was destroyed. Spontaneous combustion is invariably due to incomplete drying of part or all of the material in the heap.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1056 – **"Red Leaf" of Cotton, Prevalent where Potash is Lacking in St. Vincent, West Indies.** — See No. 1004 of this *Review*.

1057 – **The Wilt Disease of Java Indigo (*Indigofera arrecta* Hochst) in Bihar, India** (1). — HOWARD A., and HOWARD, G. L. C. (Imperial Economic Botanists) with the assistance of CHOWDRAY RAM DHAN SINGH and MAULVI ABDUR RAHMAN KHAN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. XI, No. 1, Pt. II, pp. 1-26, figs. 5, pl. IV, Calcutta, Sept. 1920.

When first introduced into Bihar from Java in 1898, *Indigofera arrecta* Hochst. did exceedingly well, yielding heavy crops of leaf, rich in indican, as well as abundant seed. After some years, however, the plant began to show increasing signs of want of vigour and finally began to die of wilt during the second half of the rainy season; at the same time the yield of seed diminished. The wilt usually makes its appearance after the first cut during July and August, the severity of the attack depending on the season. At first there is a slowing down of growth, and the leaves become folded longitudinally and assume a yellowish green slaty colour. Leaf-fall is then rapid until only a tuft of stunted foliage is left at the tips of the branches followed by a gradual dying off of the plant, one branch at a time.

The investigations on the agricultural and botanical aspects of the indigo industry were transfered from Sirsiah in 1913 to the Botanical Section of the Agricultural Research Institute at Pusa, and attention has been devoted to the causes of indigo wilt and to its prevention in view of the fact that many planters have been obliged to abandon the cultivation of indigo, while others have considerably restricted the area under this species owing to the damage caused by wilt.

A brief reference is first made by the authors to the chief factors underlying the cultivation of Java indigo in Bihar as regards soil, and rainfall.

As regards the actual cause of wilt, since the last publication on the subject (2) new investigations have been made and the former conclusions have been confirmed in all respects. When the roots and nodules of the indigo plant have suffered extensive damage, wilt invariably results from any cause which interferes with normal root regeneration. The chief source of damage to the active roots and nodules arises from the complete cutting back of the plant, which results in the destruction of practically all the fine roots and nodules. It is important, therefore, to understand fully the factors concerned in root regeneration, and the results obtained by following the root development throughout the year have proved of the very greatest value in the elucidation of this interesting problem. The root systems of numerous healthy and wilted plants have been compared in detail, the occurrence of wilt in Bihar has been studied under various conditions extending over many years, actual cases of wilt having been produced artificially in 5 different ways, while many examples of recovery have been closely examined. The conclusions arrived at, as a result of these experiments and observations, have been confirmed by a study of the behaviour of other crops during the rains at Pusa, and also by the growth of indigo on soils differing widely as regards aeration, in other parts of India: —

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(1) See *R.* July 1914, No 128; *R.* Feb. 1917, No. 136. (*Ed*).

(2) See *R.* Feb. 1917, No. 136. (*Ed.*)

1) Early bush types in which all the laterals arise at right-angles and are concentrated near the surface are the least affected by wilt;

2) Deep rooting types such as (*a*) types with a vertical habit in which nearly all the laterals are concentrated near the surface but all point downwards; (*b*) late bushy forms with a development of lateral roots from the surface to far down the main root; (*c*) late types of vertical habit with lateral roots pointing downwards arising at regular intervals down the long main root; (*d*) types with hardly any side branches but a deep tap root; these are all the types most affected.

In 1919, every case of wilt examined in detail during the monsoon was found to be associated with deep rooting, while the healthy plants were all found to be surface-rooted.

The most striking cases of recovery from severe attacks of wilt occurred in the lysimeter experiments of 1918, when plants exceedingly badly wilted, completely recovered in March 1919.

Confirmatory evidence has been obtained with *Hibiscus cannabinus* L., *H. Sabdariffa* L and *Crotalaria juncea* L. Only the surface rooting species thrived in each case during the monsoons and if waterlogged.

The stopping of selection, the mixing of kinds which is such a characteristic of native agriculture and the resulting crossing with types which do not suit Bihar, soon completely altered the botanical composition of the crop and rendered it unsuitable for growth under monsoon conditions. Indigo wilt is, therefore, another example of degeneration through vicinism.

A considerable amount of selection work has now been done on the ordinary indigo crop (1) and on the samples obtained from Java, and several of these selections have already been tested on an estate scale. Seeing that wilt has arisen from unrestricted natural cross fertilisation, the problem is now to recover the original type which suited Bihar conditions and to maintain it by continuous selection.

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(1) See *R.* Feb., 1917, No. 136. (*Ed*)

[1057]

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1058 - The Decomposition of Copper Fungicides on the Surface of Vine Leaves. —

CERASOLI, E, in the *Rivista di Patologia vegetale*, Year XI, Nos. 5-6, pp. 70-72. Pavia, August 1, 1921.

Experiments have been made to determine the comparative efficacy of Bordeaux mixture, and "Bordeaux powder," a preparation with a copper-sulphate and lime basis recently put on the market as a substitute for the ordinary copper-lime mixture used to control vine mildew.

From the results of these experiments, the author is inclined to believe, that owing to atmospheric agency, and especially to the carbon dioxide present in the air, the copper compounds in mixtures sprayed on the leaves tend to become transformed into bicarbonates of copper with the subsequent production of colloidal solutions of hydrate of copper.

Perhaps after a given time, and under favourable condition the bicarbonates and colloidal solutions of copper hydrate, after having attained a certain chemical equilibrium, give rise to carbonates of copper of a different "physical character" from that of ordinary carbonates, inasmuch as they are not affected by the carbon dioxide of the air; in which case, the colloidal solution of copper hydrate, which should prevent the development of the parasite, would not again be formed.

By studying the activity of the copper in Bordeaux mixture and "Bordeaux powder," the author has been able to determine that the leaves of vines suffering from mildew have an acid reaction. He carried out his experiment as follows:— choosing some leaves from vines that were respectively healthy, very slightly attacked by the parasite, completely withered, or still covered with the characteristic white powdery deposit, he immersed samples of each set of leaves in four glasses of distilled water, taking care that the blade alone was in contact with the liquid. After some days of exposure to the air, it was seen that only the glass of distilled water containing the healthy leaves gave a neutral reaction. The reaction of the water in the other glasses was acid, the acidity being more marked for leaves covered with white "mildew," and less for both the other samples.

In conclusion, the author thinks that the decomposition of the copper salts he studied is to be attributed to very feeble acids, or acid salts, excreted by the fungus during its passage into the leaves of the vine. Such pathological acidity would easily react upon the colloidal hydrates of copper, (but not upon the copper carbonates formed in the above mentioned manner), thus giving rise to the copper ions upon the presence of which the anticryptogamic action is supposed chiefly to depend. When these acid substances fail to find copper in a colloidal condition on the leaves, they produce such serious functional disturbances and changes, that the physiological equilibrium of the plant's economy is destroyed, and this occasions the death of the leaf or of the entire vine, that has been attacked. The author suggests that this is possibly the reason why the leaves should have at their disposal a sufficient reserve supply of efficacious copper, that is to say, copper in the colloidal state, before the spores of the fungus even begin to germinate.

1059 - **Wheat Downy Mildew (*Sclerospora macrospora* Sacc.) in Tennessee and Kentucky, U. S.** (1). — WESTON, W. H. Jr., in *United States Department of Agriculture, Department Circular* 186, pp. 1-6, Washington, D. C., June 1921.

Wheat downy mildew (*Sclerospora macrospora* Sacc) which although widely spread in Europe, especially in Italy (2) has hitherto been unknown in the United States (3) but has recently been found in Tennessee (Jackson County and Obion County) and in Kentucky (Fulton County). It seems probable that it will be found in the adjacent Illinois and possibly also in Arkansas and Missouri. In addition, diseased specimens in the pathologic herbarium at the California Agricultural Experiment Station show that the downy mildew occurred on wheat in Kings County Calif. in May 1919.

A preliminary study in Tennessee and Kentucky has shown that the disease is restricted almost entirely to low-lying, poorly drained fields in which the young seedlings of winter wheat have been subjected to excessive moisture. In such localities *Sc. macrospora* occurs especially along depressions where water has stood, whilst few if any cases are found on higher land in the same field.

The general indications from field conditions in the infected regions are that the disease is not of sudden nor recent appearance, but has been in existence for many years.

The disease is found not only on the three or four varieties of soft " Red Winter " wheat grown in these localities, but also on *Bromus commutatus* Schrad, a grass very common both in the wheat and around field borders.

After giving a description of the symptoms associated with diseased wheat plants, the author points out that the losses occasioned in the west Tennessee and Kentucky districts are apparently slight. In wet, poorly drained localities which favour the disease, large numbers of plants are affected and destroyed, but as such areas represent a very small proportion of the whole district, and as the disease is closely restricted to such localities, the total loss is not very great. This loss is, however, persistent, for the fungus survives, between wheat crops on *Bromus* or in the soil and continues, year after year, crop after crop, taking a toll, which, although slight, represents a considerable loss in the aggregate.

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(1) See *R.* Jan. 1911, No. 296; *R.* Feb. 1912, No. 416; *R.* Oct., 1915, No. 1096; *R.* Dec. 1915, No. 1346; *R.* Oct. 1916, No. 1128 *R.* Apr. 1917, No. 381; *R.* Sept. 1917, No. 872; *R.*, Apr. 1918, No. 477; *R.* Sept. 1918, No. 1053. (*Ed.*)

(2) For bibliographical information on this subject, see *R.* Oct. 1915, No. 1096. (*Ed.*)

(3) B. M. DUGGAR. *Fungous Diseases of Plants.* Boston-New York-Chicago-London, Ginn and Co. 1909, p. 161 and F. L. STEVENS and J. G. HALL. *Diseases of Economic Plants.* New York, Macmillan and Co., 1910, p. 342 indicate the fact that this fungus' is parasitic on maize in the North American Confederation, where according to F. L. STEVENS in *The Fungi which cause Plant Diseases,* New York: Macmillan it C° 1914 p. 90 it has already been noted on wheat. (*Ed.*)

Effective methods of control are now being studied by the Office of Cereals Investigations, Washington.

1060 - **Diseases of Cotton in St. Vincent' West Indies.**— See No. 1004, of this *Review*.

1061 ***Colletotrichum Agaves*, a Deuteromycete Injurious to *Agave* spp., in Indo-China, the French Sudan and France.** — CHEVALIER, A., in the *Revue de botanique appliquée et d'Agriculture Coloniale*, Vol. I, No. 1, pp.21-23. Paris, May 15, 1921.

The author had already for some time noticed the presence, on the lower leaves of specimens of sisal (*Agave rigida*) in both Indo-China, and the French Sudan, of elliptical brown patches elongated in the direction of the long axis, and more or less confluent. Some of the tissues of the portions attacked decay, and very badly infected leaves are wholly useless.

During 1915 and 1916, the author sometimes found similar patches on plants of *A. americana* growing in France, on the Côte d'Azur (Nice, Monaco, Mentone).

In March, 1921, he reported that many specimens of *Agave* in the Roucas Blanc Park near Marseilles, especially those growing in places where they were exposed to the wind, had on their old leaves, brown patches similar to those disfiguring the agaves in Indo-China, French Sudan and the Côte d'Azur.

Examination of the diseased leaves enabled M. PATOUILLARD to state, that the spots were produced by the Melanconia *Colletotrichum Agaves* Cav. originally described as occurring in Italy.

The malady either appeared for the first time in Roncas Blanc Park last winter, or else developed there then to an unusual extent, but the brown spots on the leaves were at first attributed to the effect of the severe frosts on December 15 and 17, 1920, which killed or injured so many foreign plants that had been acclimatised in South France.

The fungus has only been recorded as attacking *A. Americana*, *A. Salmiana*, and their variegated forms. Specimens of *A. applanata* growing amongst the preceding species were not infected.

The disease shows itself in the form of a small, brown spot, that gradually increases in size, finally attaining the diameter of 3.4 cm. At this point, the parasite stops growing, and the patch assumes an irregular shape, its long axis bring parallel to the length of the leaf.

According to the statement made by the owner of Roncas Blank Park, the disease is little to be feared at present, for though it impairs the beauty of the leaves of the host-plant, it does not affect the plant's vigour.

Nevertheless, in the opinion of the author, the malady should be controlled by cutting off the diseased leaves and burning them in a brazier after first sprinkling them with petroleum. It is particularly advisable to take this precaution in large tropical plantations, where there are many plants whose the leaves show the characteristic brown patches, to be attributed, at all events for the present, to the action of *Collet. Agaves.*

In 1913, Mr. SHAW recorded this disease, under the name of " anthracnose of sisal hemp, " as occurring in several parts of India. He obtained pure cultures of *Colletotrichum* and was able to reproduce the disease artificially. The fungus is one of the wound-parasites often found on leaves, especially after periods of drought producing longitudinal cracks. SHAW recommends spraying with Bordeaux mixture as being the best means of preventing the spread of the disease.

There is in the cryptogamic Herbarium, in the Paris Museum, another Melanconia, *Gloesporium Agaves* Sydow, that was found in 1918, on a species of *Agave* in Brazil. Nothing is so far known as to the injury it can do.

As the genera *Colletotrichum* and *Gloesporium* are very nearly akin, further researches are necessary, in order to find out the relations that may exist between the two above-mentioned fungi.

1062 - **Bacterial Wilt (*Bacterium Solanacearum*) of Castor Bean in Georgia, Florida and Alabama, U. S.** — SMITH, E. F., and GODFREY, G. H., in *Journal of Agricultural Research*, Vol. XXI, No. 4, pp. 253-262, figs. 1, pl. 13. Washington, D. C., May 16, 1921.

The bacterial wilt of castor beans caused by *Bacterium Solanacearum* E. F. S., was first brought to the attention of the authors in May 1918, when spècimens of diseased plants were received from Townsend (Georgia) and was notified shortly afterwards in Florida and in Dothan (Alabama). It is very likely that the disease occurred also in North and South Carolina and in Mississippi.

The highest reported loss was 30 % in a field in southern Georgia.

As regards the distribution of bacterial wilt the east coast section, where the disease appeared to be absent, differs from the interior and west coast sections of Florida rather strikingly in that an abundance of lime is present in the soil.

In addition to this, it was noted both in Florida and in Alabama that plants on newer land appeared to be more subject to attack than land that had been longer under cultivation.

The disease produced by *Bact. Solanacearum* in the castor bean as in Solanaceous plants is a true wilt of the green leaves and growing points, without previous yellowing or other partial or complete discoloration. It may occur when the plants are small in which case it is likely to prove fatal. It is also found in plants of all sizes. In smaller plants a single leaf may wilt and the vascular system near the base of the plant may show internal browning or even the entire plant may droop. The wilting may come about very suddenly or slowly. The first manifestation of wilt often appears after a period of wet weather of several days duration, such weather apparently favouring infection. Wilt is found more frequently in hot, dry weather. Often a plant may recover temporarily during moist weather or during a cool night after a hot dry day which has resulted in the appearace of wilt. Sometimes this recovery leaves a shrivelled tip or margin on some of the leaves. The ultimate result of the wilt in the more severe cases at least is the complete death of the plant. In many plants infection occurred late in the season but was not severe enough to cause permanent wilting or death. In such cases marked dwarfing was evident.

The wilt can be distinguished easily from the other diseases of castor bean known up to the present by the typical browning of the vascular system near the base of the plant. In the more severe cases this browning is seen in the entire vascular ring penetrating more or less deeply into the woody part of the stem. In cases of light infection, such as in the dwarfed plants mentioned heretofore, the browning may be seen in only a few bundles all possibly on one side of the stem. In addition to the browning it is always possible with the aid of a good lens, to observe drops of bacterial exudate at the freshly cut ends of the vascular tubes, particularly if the plant is still green. Sometimes it is necessary to pinch the end of the stem to force these drops to the surface.

The Ricinus organism was inoculated successfully not only into other Ricinus plants but also into tomato plants, jimson weeds (*Datura stramonium*), common nasturtium (*Tropaeolum majus*), cotton, vanilla (*Vanilla planifolia*), sunflower (*Helianthus annuus*), balsam (*Impatiens Balsamina*) and fuchsia.

1063 – *Fumago* sp., a Hyphomycete Injurious to the Myrtacea *Metaleuca Leucadendron* var. *viridiflora*, in New Caledonia.

– NICOLAS CH., in the *Bulletin de la Société de Pathologie exotique*, Vol XIV, No 7, pp 396-397 Laval, 1921.

As long ago as 1919, the author had observed that the leaves and branches of several specimens of *Melaleuca Leucadendron* (the Myrtacea furnishing essence of niaouli), growing on a spot situated between Honaïlon and Pouérihouen in New Caledonia, were attacked by *Fumago*, which had also infested other trees in the neighbourhood.

The found that the disease gradually spread during the following two years, and it now extends from Houaïlon to Poindimié, a distance of 70 km., although it is still rarely met with at either end of the line, the centre of the disease being at Mouet and Monéo.

The author studied the behaviour of the trees first attacked. For a long time, they resisted the parasite, and seemed at first to get the better of it by means of putting out a number of fresh shoots. In the long run, however, the leaves fell and the trees succumbed after about two years.

Microscopic investigation revealed the presence of a fungus on the surface of the parenchyma of the leaf, which in MOLLIARD's opinion, could be none other than a variety of *Fumago*, a saprophyte of but little importance when growing upon the " honey dew " produced in consequence of the punctures made by a coccid belonging to the genus *Ceroplastes*, which is said to be the primary agent.

The disease does not confine itself entirely to *Melaleuca*, and it is to be feared that one day it will attack the coffee plantations, and perhaps the coconut-palm groves.

1064 – *Phyllosticta Caricae-Papayae*, Leaf Spot of the Paw-Paw (*Carica Papaya*) in Natal, South Africa. — VAN DER BIJL, P A, in *The South African Journal of Science*, Vol XVII, Nos. 3-4, pp 288-290 Johannesburg, July 1921.

A leaf-spot disease of the paw-paw (*Carica Papaya*), characterised by discoloured spots is not uncommon in Natal; these spots may be circular or angular, or more or less elongated in one direction. They are frequently surrounded by a yellow or brownish ring which passes into the normal green of the leaf. On the upper leaf surface, small black dots are evident in these discoloured areas, and they are the pycnidia of the causal fungus.

The leaf tissues in the infected areas become brittle and ultimately fall out, giving the leaves a "shot-hole" appearance.

The fungus was isolated from infected leaves, Pieces of mycelium from a pure culture were artificially inoculated into leaves of *C. Papaya*, and after a few days, the characteristic symptoms of this disease were reproduced. The assimilating area in attacked leaves was diminished.

The infection of a paw-paw through a puncture would indicate that this fungus may also play some part as a causal agent of a fruit rot of *C. Papaya*.

The fungus here described is referred to as *Phyllosticta Caricae Papayae* Allesch. generally recognised as living on *C. Papaya* in Brazil.

1065 – *Phoma Ferrarisii*, n. sp., a Deuteromycete Causing Tomato Rot in Piedmont, Italy. — CIFERRI, R, in the *Rivista di Patologia vegetale*, Year XI,. Nos, 5-6 pp 65-69. Pavia, August 1, 1921.

Towards the end of June, 1921, a tomato was gathered in the vicinity of Alba (Prov. of Cunéo), which was externally shrivelled and flaccid, as well as a little discoloured, though the skin was intact, except at one place, where a brownish cavity could be seen; the cavity extended into the interior of the fruit. On being cut, the fruit was found to consist chiefly of a mass of decomposed almost black pulp. The healthy remainder of the parenchymatous tissue was separated from the diseased portion by a reddish layer. From the rotting pulp, there emerged numerous black bodies (pycnidia) of a fungus which, after microscopic examination, was referred to the genus *Phoma*, and is provisionarily described in the present preliminary note, as a species new to science, under the name of *Ph. Ferrarisii*.

By means of artificially inoculating sound, green fruits, symptoms identical in every respect with those observed in nature were induced in a very few days, hence there is no doubt, that the disease is due to the parasitic action of the above-mentioned spherioïdea.

One fact worthy of notice is that the disease — called by the author tomato rot — if not too far advanced, does not prevent the green tomatoes ripening, but the course of the disease is not checked by maturation.

From the results of the observations hitherto made, it would appear that the parasite penetrates into the fruit through a break in the epidermis.

The disease is of very rare occurrence; only a very few infected fruits were discovered on two of the tomato-plants growing in a kitchen-garden.

Subsequent observations have shown that on certain of the diseased fruits a greyish-white, or whitish, mucidinea (*Ramularia* sp), is present on the surface or in some of the superficial layers, which may also perhaps have a metagenetic relation to *Ph. Ferrarisii* or be merely a secondary parasite.

1066 - ***Bacterium marginatum*** **n. sp., Injurious to *Gladiolus* spp. in the District of Columbia and in Illinois, U. S.** — MC.CULLOCH, L., in *Science*, New Series, Vol. LIV, No. 1388, pp. 115-116, Lancaster, Pa, Aug. 5, 1921.

Preliminary description of a bacterial disease of *Gladiolus* spp. caused by *Bacterium marginatum* n. sp. The author gives the morphological characteristics and states that the micro-organism is pathogenic in leaves of the plant, forming circular or elliptical lesions rusty red in colour, becoming dull brown or purplish. These spots may occur on all parts of the foliage, but are often confined to the lower leaves. Observation and experiment indicate that the disease makes rapid and dangerous progress only in warm and moist weather when the rot spreads widely and deeply into the tissues, causing collapse of the aerial part of the plant.

The disease is very prevalent in and round the District of Columbia. In the fields examined 80 to 90 % of the plants were affected but in the majority of these cases not so severely as noticeably to arrest the development and bloom of the plant.

Specimens of *Gladiolus* with the same disease have been received from Illinois, with the information that it has caused loss to the growers. Some plants from California apparently had not the same disease but the case was not completely proved.

The organism has been isolated repeatedly and its pathogenicity proved by the inoculation of healthy plants.

1067 - ***Phytophthora*** **sp. Peronospora Injurious to Peonies in Pennsylvania.** — THURSTON, H. W., and ORTON, G.R., in *Science*, New Series, Vol. LIV, No. 1391, pp. 170-171, Lancaster, Pa., Aug 26, 1920.

Early in May, 1921, the authors received from Eric (Pennsylvania) some blighted peonies for examination. Since the cause of the trouble was not at first apparent, cultures were attempted from the diseased portions. These gave at once a pure growth of *Phytophthora*, a Peronospora which had not previously been reported as parasitic on this host-plant.

On the plants in question, the disease was manifest as a necrotic condition of the bud, involving also the surrounding leaves and extending for several inches down the stem. In general appearance, the symptoms are similar to those caused by *Botrytis*, although the infected areas are a darker brown or black. No evidence of external fruiting of the parasite was found either upon the original specimens or upon plants subsequently artificially infected. Inoculations of the pure culture into healthy peonies, however, readily produced infections and the characteristic symptoms, from which the organism was re-isolated with ease. Inoculations were made upon plants growing outside, with pure culture, using pieces of mycelium and zoosporangia, and these were successful both with and without wounding of the host. The characteristic symptoms appeared in from 3 to 6 days.

The disease in question develops rapidly upon a variety of artificial media, and in this respect differs from *Phyt. infestans*.

The measurements of the zoosporangia which are produced in abundance, correspond closely to those for the zoosporangia of *Phyt. infestans* but are somewhat broader than those of *Phyt. Thalictri* which would appear to be its closest relative so far as hosts are concerned. Oospores have not been observed either in cultures or tissue sections of the infected plant.

1068 – **Diseases and Pests of Citrus Fruits in the United States, Porto Rico and India.** — See No. 1011 of this *Review*

WEEDS AND PARASITIC FLOWERING PLANTS

1069 ***Cascuta Racemosa*** **Recorded on Lucerne in Rio Negro, Argentina.** — BARCIA TRELLES J., in *El Campo*, Year V, No 58, pp 921-927, figs. 9. Buenos Aires, August 15, 1921

Small patches of *Cuscuta racemosa* Mart. have been observed in some lucerne fields of Rio Negro, and it would therefore appear that this much-dreaded parasite has attacked the leguminous crop which constitutes the chief source of the agricultural wealth of the district.

For the moment little injury has been done, as the parasite has only just begun to attack the crops.

C. racemosa is, however, the most common species of the genus in Argentina, and the only one that has hitherto found its way to Río Negro. Its appearance is a serious menace, for it can easily in time develop into a veritable pest, if efforts are not made at once to extirpate it before it has taken much hold. The multiplication of the parasite would not only greatly reduce the local forage production, but also bring discredit upon the Río Negro lucerne seed, which has hitherto been regarded as the best in Argentina, owing to its purity, and especially to the fact, that it has always been found free from dodder.

The author describes the morphological characters of *C. racemosa*, as well as its life-history, and the best means known at present for controlling it.

1070 – **Leafy Spurge (*Tithymalus Esula* = *Euphorbia Esula*) Harmful Weed in the United States.** — BRITTON N. L., in *Journal of the New York Botanical Garden*, Vol XXII, No 256, pp 73-75, fig 1. Lancaster, Pa, April, 1921.

About 100 years ago, possibly even earlier, the leafy spurge (*Tithymalus Esula* Hill [= *Euphorbia Esula* Linn.]), a native of Europe, obtained a foothold in Essex County (Massachusetts). The actual date of its introduction is not definitely known, but a specimen preserved in the Torrey Herbarium of Columbia University, deposited at the New York Botanical Garden, was collected at Newbury (Massachusetts) by OAKES in 1827. For many years, this Euphorbiacea was not noticed elsewhere in the United States. But in 1848, GRAY stated that it was likely to become a troublesome weed. In 1880, ROBINSON records it as very abundant near Newbury port; this is probably OAKE'S locality. In 1886, DUDLEY records the plant as found at Groton (New York) and remarks on its rarity. In 1881, WHEELER and E. F. SMITH record it as having escaped cultivation and somewhat rare in Michigan State. By 1913 the plant had apparently extended to Maine, Ontario and New Jersey; it is only in recent years, however, that GRAY'S surmise has become a fact and farmers in Orange County (New York) and elsewhere now find this weed a menace to pastures. Measures to prevent propagation or to eradicate completely are being taken, but the task is not an easy one, as the plant has horizontal rootstocks formed anew each year.

If the weed is detected it is advised to fork or dig it out of the ground and burn, taking care to destroy all the underground parts.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1071 - **Observations in Italy on the Polyphagous Nature of the Macrolepidopteron, *Attacus cynthia*.** — ZANON, V, in the *Rivista Agricola*, Year XXVI, No 36, pp 511-512 Parma, September 9 1921

The macrolepidopteron, *Attacus cynthia*, was introduced from China into Europe where its caterpillars had always confined themselves to a single plant-host, *Ailanthus glandulosa*; in October 1920, the author found them living at the expense of the plane-tree, some specimens of which had been seriously injured by the larvae in different localities. In November the insects attached their cocoons to the trees. Later on, in the course of the winter, ZANON found numerous cocoons of *A. cynthia* hanging from the boughs of pear, cherry and plum-trees growing in other gardens of the same district.

During the first fortnight of June 1921, the author obtained from cocoons he had collected from the plane-tree the preceding winter and laid aside, a certain number of the adult macrolepidopteron; the females after mating laid eggs, which yielded caterpillars at the end of the same month; the caterpillars were placed on pear and plum branches kept in vases full of water in a room, where they lived on the leaves

The author believes that the adult insects of the first generation that hatch in June from the cocoons attached to the plane-tree, seek out their true host, *Ailanthus glandulosa*, where they deposit their eggs, but that those of the second generation, owing to the scarcity of this plant, are obliged, in order to rear their more numerous progeny, to have recourse to other species. Hitherto, they have manifested a predilection for the plane, but as has been seen, they also attack pear, cherry and plum trees

If the first generation should also develop upon fruit-trees, the danger would be of a serious character. In order to avert it, the only way is to collect the winter cocoons, or to pull up the *Ailanthus* trees, which do not yield good wood, or even brushwood, and only encumber the ground.

1072 - **On the Resistance of the Adult Cockchafer to High and Low Temperatures.** — FAES, H. and STAEHELIN, M., in the *Comptes rendus hebdomadaires des Seances de l'Académie des Sciences*, Vol. CLXXII, No 1, pp 61-64. Paris, 1921

It has often been stated by agriculturists that the return of cold weather, especially when accompanied by severe frost, kills a certain number of cockchafers.

In order to see how far this idea was correct, on May 21, 1921, the authors exposed some adult specimens to different degrees of low temperature in the cold storage chamber belonging to the new Federal Vine-Growing Experiment Station at Lausanne (Switzerland).

At first the temperatures employed were not below —8° C. but it was found that greater cold was necessary to kill the adult cockchafer.

The results of the experiments are as follows

Date of experiment	Temperature (n degrees C.)	Length of exposure	Number of cock chafers	Results of examination on May 21	
				Dead cock chafers	Living cock chafers
18 May	—18° — 16°	1 hour	6	6	0
»	—14° — 12°	»	6	6	0
»	— 8°	»	6	2	5
»	— 6°	»	6	1	5
11 May	— 4°	»	30	6	24
»	— 2°	»	30	5	25
»	0°	»	28	3	25
»	+ 2°	»	30	2	28

So that the conditions should be as far as possible natural the authors also left in the cold chamber different lots of cockchafers that were exposed respectively to low temperatures of long duration, and to progressive lowering and raising of the temperature. One lot was placed in a vessel filled with sand, which allowed the insects to escape from the cold, should the temperature be too low for their liking.

In this new set of experiments, the cockchafers exposed for 30 hours to temperatures between +5° C. and —6° C. or for 174 hours to temperatures varying from +7° C to —6° C. did not all die; on an average, one third of then were able to resist the action of the cold.

When subjected to temperatures of nearly 0° C. or below 0° C, adult cockchafers usually become motionless or freeze. They, however, thaw rapidly, and as a rule, run about after they have been removed 1 hour from the cold chamber.

As soon as they felt the cold, the cockchafers in the vessel filled with sand quickly dug themselves in, burrowing to a depth of 10 cm.

It is thus seen, that these insects when full-grown can easily stand the lowest temperatures produced in Europe by the return of cold weather in spring. In order to destroy them all, the temperature of the air would need to fall below −8° C. which never occurs under the climatic conditions obtaining in spring. These experiments also prove that the adult cockchafer will bury itself in the ground, in order to escape from any cold that might injure it.

The authors thought it would also be interesting to determine the resistance of adult cockchafers to high temperatures For this purpose, they exposed several lots of these insect to different temperatures in a gas-heated dessicator provided with a regulator. The following results were obtained . —

Date of experiment	Temperature (in degrees C.)	Length of exposure	Number of cockchafers	Results of examination on May 21	
				Dead cockchafers	Living cockchafers
13 May	+ 35°	1 hour	14	7	7
»	+ 40°	»	15	9	6
»	+ 45°	»	15	15	0
»	+ 50°	»	15	15	0
»	+ 55°	»	16	16	0

With a view also that the conditions should be as far as possible natural, the authors exposed one lot of cockchafers to a hot air current. As in the experiment in the cold chamber, a certain number of insects were placed in a vessel filled with sand which enabled them to escape excessive heat.

The following results were obtained :—

Date of experiment	Temperature in °C.	Length of exposure	Number of cockchafers	Results of examination on May 21	
				Dead	Living
May 13	+ 35° to 55°	8 hours	5	15	0
Lot in the vessel containing sand:					
May 13	+ 35° to 55°	8 hours	15	15	0

Although the adult cockchafer is remarkably resistant to cold, it is on the other hand, relatively susceptible to a great rise in temperature. At +55° C all the insects succumbed.

[1072]

In order to escape from too high a temperature, most of the insects shut up in the vessel filled with sand buried themselves to a depth of 10 cm., but whether they remained on the surface, or burrowed beneath it, they were all destroyed during the 8 hours' exposure, the temperature at the bottom of the vessel being probably +45° C., their limit of resistance.

The adult cockchafer is perfectly adapted to this climate, and is little affected by the lowest or highest temperatures our spring has to offer.

1073 - **Barley Varieties Resistant to *Heterodera schachtii* in Sweden.** — See No. 994 of this *Review*.

1074 - **The Introduction into Southern France of the Australian Coccinellid, *Cryptolaemus montrouzieri*, a Natural Enemy of Scale Insects (*Pseudococcus*)** (1). — MARCHAL, P., in the *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. CLXXII, No. 2, pp. 105-107. Paris, 1921.

In July, 1918, the Insectarium at Mentone received from the similar institution at Sacramento (California), 15 larval and 3 adult specimens of *Cryptolaemus montrouzieri* Muls. a coccinellid of Australian origin, which has proved to be a most determined enemy of scale-insects. Amongst the latter must be reckoned the members of the genus *Pseudococcus*, which in company with " fumagine," cause the destruction of the orange and lemon gardens in Southern France, as well as injury to the various crops grown there. A second consignment consisting of about 500 insects was sent to Mentone from Sacramento in the beginning of 1919.

In the spring of that year, the coccinellids on the apple-shoots infested with *Pseudococcus* in the laboratory cages at Mentone had multiplied to such an extent as to admit of their being set free.

Colonies of *Crypt. montrouzieri* established themselves during 1919 and 1920. In 1919 each colony contained 50 to 60 of the insects. Altogether a thousand were set at liberty in different lots on the estates, or public walks of Mentone, Garavan and Cabbé-Roquebrune. In 1920, new centres of dispersal were formed, each provided with a thousand insects, in other parts of Mentone, and in the Principality of Monaco. In addition, some colonies were dispatched to Algeria and Italy.

This year, the insects have been found in large numbers in the various places where colonies were established in 1919, and in places far off from the 1920 centres. It has thus been proved that *Crypt. montrouzieri* paspass the winter in the open at Mentone, in spite of the abnormal cold it experienced, and had managed to exist from the one year to the next, and further to reproduce itself.

In an orange garden in which a colony of these insects had settled in August 1919, they succeeded in multiplying to such an extent, in spite of the very unfavourable conditions occasioned by a thorough pruning, that all the trees infected with *Pseudococcus*, bore a larger or smaller number of *Cryptolaemus*, so that the invasion of the scale-insects had been checked.

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(1) See on this subject, *R.* July 1914, No. 697; *R.* March 1916, p. 354; *R.* July, 1921, No. 872. (*Ed.*).

From what has been said, it is clear that *Crypt. montrouzieri* is in process of becoming acclimatised on the French portion of the Mediterranean coast, where it also will do good service in attacking the scale insects (*Pseudococcus*), which are so injurious to the southern crops, and have proved exceedingly resistant to all the control measures hitherto taken against them.

1075 - **The Natural Enemies of *Xylotrechus quadripes* and of *Chlorophorus annularis*, Beetles Injurious to the Coffee-tree and the Bamboo Respectively, in Tonkin.** — KIEFFER, J. J., in the *Bulletin agricole de l'Institut scientifique de Saigon*, Year III, No. 5, pp. 129-140. Saigon, May 1921.

In Tonkin the larva of the Cerambycid *Xylotrechus quadripes* Chevr (1) makes galleries in the trunk of the coffee-tree, thus hindering its growth, and greatly reducing the crop. The larva of another Cerambycid, *Chlorophorus annularis* Fairm. destroys the stems of the bamboos in a similar manner.

The Entomological Station of Cho-Ganh has begun to combat these insects by breeding and setting free their natural enemies which belong to the order of Hymenoptera, and are here described by the author from a systematic standpoint : — (A) fam. *Braconidae* :— 1) *Duportia cinticornis* n. gen. and n. sp., parasitic on the larvae of *Chlor. annularis* ; 2) *Promiscolus sesquistriatus* n. gen. and n. sp., parasitic on *Xyl. quadripes* and of *Chlor. annularis* ; 3) *Pristodoryctes striativentris* n. gen. and n. sp., parasitic on the larvae of *Xyl. quadripes* ; 4) *Doryctes tristriatus* n. sp., parasitic on the larvae of the two Cerambycides ; 5) *D. strioliger* n. sp., as above ; 6) *D. picticeps* n. sp., as above ; 7) *D. bistriatus* n. sp., as above ; 8) *D. brevipetiolus* n. sp. as above.

(*B*) fam. *Ichneumonidae :— Paraglypta tubigera* n. gen. and n. sp., parasitic on the larvae of *Xyl. quadripes.*

(*C*) fam. *Evaniidae :— Pristaulacus nigripes* Kieff. var. *Duporti*, n. var. obtained in large numbers from the larvae of *Xyl. quadripes.*

(*D*) fam. *Bethylidae :—* 1) *Sclerodermus domesticus* Latr.; very common as an ectoparasite of the larvae of *Xyl. quadripes*, and of *Chlor. annularis*, also destroys the above-mentioned larvae and adult forms of the fam. *Braconidae* ; 2) *Misepyris grandiceps* n. sp. parasitic on the larvae of *Xyl. quadripes.*

1076 - **Animal Pests of the Cacao Tree in the Dominican Republic.** — WOLCOTT, G. N., in the *Revista de Agricultura de Puerto Rico*, Vol. VI, No. 6, pp 11-12. San Juan, P. R., June 30, 1921.

Rodents and birds do considerable damage to the cacao-tree in the Republic of Dominica, where they devour the seed of the fully-grown fruits and in some places nearly half the crop is lost by this means.

When grown on virgin soil, these trees are usually attacked by the larvae of a beetle, *Strategus titanus* Fabr., which feed upon their roots, but these pests can be got rid of by carefully and thoroughly cleaning the ground.

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(1) See *R.* May 1911, No. 1338. (*Ed.*)

The larvae of *Bocchoris pharaxalis* Druve devour the young leaves of the shoots, producing irregularly-shaped holes in them. The larvae could probably be destroyed by the use of arsenical sprays, but under the present conditions the best method of control is to pick them off by hand.

Still more dreaded enemies of cacao are the aphis *Toxoptera aurantii* Boyer, and the scale-insect *Pseudococcus citri* Risso. The first is found on the youngest leaves, the floral buds and the peduncles of the fruits while they are small. The scale insect also frequents the peduncles of the flowers and fruits, and even occurs on the fruits themselves, especially in the least exposed places, where two fruits touch one another or one touches the trunk of the tree. Owing to the punctures made by the insects in the peduncles, the floral buds wither before unfolding, and the already-open flowers wither and fall; the large number of mummified fruits show that development has been checked by the presence of the scale-insects.

The aphids and the coccids are accompanied and protected by the formicide, *Solenopsis geminata* Fabr. If the latter is prevented (by a band of " tanglefoot " round the trunk) from ascending the tree, or if the ants are killed by flooding their nest several times with an emulsion of carbolic acid and soap, the aphids and coccids very soon decrease greatly in number. It would certainly be advisable to destroy these two species of insect directly, but it is useless to spray cacao-plantations where the trees grow close together without any order, and are left unpruned, as is generally the case in the Republic.

1077 - ***Lonchaea aristella*, a Dipteron Injurious to the Fig-Tree, and New to France** (1). — POUTIERS, R., in *Le Progrès Agricole et Viticole*, Year XXXVIII, No 38, pp. 285-286. Montpellier, September 18, 1921.

For two years, the author has noticed that certain varieties of figs at Mentone are covered with punctures, and infested with the larvae of a dipteron, which by eating out the interior of the receptacle (syconus), cause it fall prematurely.

Since May he has reared many adult insects from these larvae which have been identified as *Lonchaea aristella* Beck, thus proving the truth of the suspicion that this pest has found its way to France.

No natural enemies of the dipteron have so far been found at Mentone by the author.

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(1) See on this subject: *R* July 1915, No 777; *R* Feb. 1918, No. 249; *R.* June 1918, No. 716. (*Ed.*)

ALFREDO RUGGERI, *gerente responsabile.*

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1078 - **The Agricultural Development of the State of Minas Geraes (Brazil): The Message of H. E. Dr. Arthur de Silva Bernardes in the Third Session of the Eighth Legislature.** — *Lavoura e Criação*, Year VI, No. 7, pp 134 150 Rio de Janeiro, July, 1921.

The Message of the President of the State of Minas Geraes on the occasion of the third ordinary session of the eighth Legislature, which was opened on July 15, 1921, treats of the finances, agriculture, and industries of that flourishing country, and draws special attention to the work done by the Government for the encouragement of agriculture and stock-breeding.

The most important data relating to these efforts and to the conditions of agriculture figure in this report.

SCIENTIFIC AND AGRICULTURAL INSTRUCTION. — 1) *Agricultural Veterinary College.* — The institution of this College was decreed by Law No. 961, dated September 6, 1921: Decree No. 5623 of March 7, 1921, allocates for this purpose a sum of 1000 *contos de reis*. The organisation has been entrusted to Dr. P. H. ROLFS.

2) *Institute of Industrial Chemistry.* — This will be attached to the Bello Horizonte " Escola de Engenharia, " and is now being erected. It was hoped that the Institute would be ready for opening in 1921.

3) *Agricultural Institutes.* — There are three of these supported by the State viz., the João Pinheiro Institute, near Bello Horizonte, the Don Bosco Institute at Itajubá, and the Bueno Brandão Institute in the Municipality of Mar de Hespanha. In 1920 these three Institutes cost

the State respectively 16 014, 59 742 and 41 051 *milreis*. To the João Pinheiro Institute is attached the Gamelleira farm, which is used for purposes of demonstration, and for practical instruction of the students. Young men of at least 18 years of age, and desirous of obtaining a certificate testifying to their fitness for the exercise of the duties of "mestre de cultura" (agricultural teachers) are also admitted to this Institute.

4) *Schools of Practical Agriculture, or "Aprendizados"* — Of these there are 2, both founded and supported by the State: the José Gonçalves School at Ouro Fino, and the Borges Sampaio at Uberaba. For these the sums of 32 649 and 38 816 *milreis* were expended in 1920. These schools are entirely devoted to practical instruction in agriculture; their aim is to produce good country workers having a thorough knowledge of modern methods of mechanical cultivation, irrigation and the use of fertilisers, etc.

In addition the State subsidises the "Aprendizado" which is annexed to the "Colonia indigena" of Itambacury in the municipality of Theophilo Ottoni.

5) *Subsidised Institutions*. — In accordance with the "Lei orçamentaria" (Budget Law) of 1920, the State allocated the following subsidies to these Institutions of Professional and Agricultural Instruction: — Escola de Engenharia of Bello Horizonte, 50 000 *milreis*; Istituto Electro Technico e Mecanico of Itajubá, 25 000 *milreis*; "Escola Agricola de Lavras" and "Escola D. Bosco" of Cachoeira do Campo, 10 000 *milreis* each; Aprendizado agricola" annexed to the "Gymnasio Leopoldinense" 5 000 *milreis*; "Escola Mineira de Agronomia e Veterinaria" of Bello Horizonte 4000 *milreis*; "Escola professional Delfim Moreira" of Porto Alegre 2500 *milreis*; "Escola do Commercio" of Bello Horizonte 2000 *milreis*; total amount of grants: 118 500 *milreis*.

6) *Travelling Instruction*. — This is almost at its beginning, and may therefore be said to be in the experimental stage. In 1920, the "mestres de cultura" visited 271 agricultural farms, and it is thanks to their propaganda, that so many agricultural machines have been used. One of these "mestres" has introduced a new type of tobacco drier which gives a better colour to the dried leaves. The use of this apparatus at once increased the market value of dried tobacco leaves which has risen from 4 to 6.5 *milreis* per kilogram.

AGRICULTURE. — The following data, which refer to 1920, bring out clearly the great importance of agriculture in the State of Minas Geraes

	Value of exports. Milreis	Returns of the export tax	
		Absolute value	% of total
Agricultural industry	195 196 702	13 175 723	55.21
Stock-breeding.	182 234 482	7 091 411	29.78
Manufacturing Industries	43 980 422	1 613 808	6.76
Extractive Industries	32 948 508	1 965 154	8.22

The increased value of the chief Brazilian products during the war induced a considerable rise in the exports, and hence a great influx of capital, which was used, by preference, in the development of agricultural production : enlarging plantations, the introduction of new crops, the purchase of machines, etc.

The traditional crops of *maize, haricot beans* and *yams* are continually developing, and motor-ploughing has already been introduced into certain zones.

Coffee is still the chief source of public and private wealth. *Rice* appears to have found conditions that suit it perfectly in the regions on either side of the Rio Grande, viz., in the municipalities of Sacramento, Conquista and Fructal, as well as at Uberabinia, Araguary, and other centres. The rice-fields on the banks of the Rio Grande already form one of the granaries of the country, and their importance will still further increase when transport is rendered easier by the works undertaken to ensure the navigability of the the Rio Pardo from its mouth as far as the Station of Jaguará. The states of Minas and of São Paolo as well as the Federal Government are interested in these works.

Rice-growing is a very favourite industry in other parts of the South and West of the State; for instance in Matta where in the municipalities of Leopoldina, Cataguazes, Ubá, São João Nepomuceno, Rio Branco, Viçosa, Ponte Nova, Abre Campo, and Rio Casca alone, the crop totalled 750 000 sacks.

Sugar-cane cultivation is constantly extending, and is very successful. New modern sugar factories are being built. As alcohol is very heavily taxed, the canes are more used for sugar-making than for distillation. In 1920, the export was 15 909 423 kg. of sugar, or 10 427 901 kg. more than in 1919.

The Government has engaged specialists for the purpose of restoring the *tobacco-growing* industry of the State which reached its height in the middle of the last century but has since declined because the cord tobacco of the State of Minas Geraes has been supplanted by the lighter-coloured and more delicate leaf-tobacco, produced in Bahia and Rio Grande do Sul.

The efforts made by the Government to develop *fruit-growing* have been crowned with success ; the fruits of Barbacena, Maria da Fé, Silvestre Ferraz, etc. are fully equal in colour and flavour to the European products ; the State already exports large quantities of plums, pears, apples, grapes, peaches, mangoes, and pine apples.

Everything makes it probable that *cotton* will become one of the State's permanent sources of revenue, as soon as proper methods of cultivating and preparing the crop are adopted. The Secretary of the Manchester (England) Cotton Association states that the cotton of Minas is generally of excellent quality, the fibre sometimes being 32 mm. long. The river district of San Francisco is especially suitable for this crop. The Government has drawn up a scheme for establishing a Cotton-Growing College in this region, and a Station for the selection and distribution of cotton seeds. Other crops worthy of mention are *potatoes* (chiefly in the

Southern part of the State); *cacao*, on the frontier of Bahia; *tea* in the neighbourhood of Ouro Preto; *onions, groundnuts, kitchen-garden plants*, etc.

MEASURES TO ENCOURAGE POWER-FARMING. — In order to encourage the use of agricultural machines, the State imports them, and allows the agriculturists to buy them at cost price with free transport by rail. In 1920, 1380 agricultural machines were imported, 281 apparatuses for destroying ants, 2168 diggers, etc. Seed sorting-machines were also purchased and are about to be set up. Depots for agricultural machines have been established in many municipalities, and entrusted to the "Cameras Municipaes" which keep, exhibit and sell the machines at the price paid for them by the State.

The Government occupies itself with the purchase within the State, and outside its frontiers, of sound selected seed, which it sells to the agriculturists at cost price. This work cannot, however, be thoroughly carried out, until a special Institute is founded for the purpose.

The "Horto florestal" of Boa Vista (6 km. from Bello Horizonte) does excellent service in re-afforestation. It supplied a large number of cuttings, especially of eucalyptus, to the Municipalities for planting along the roads, and to private individuals for afforestation. The State gives each agriculturist cuttings up to the number of 5000, carriage-free by rail; and will supply more, with the sole stipulation, that the "Secretaria da Agricultura" be informed of the results obtained.

STOCK-BREEDING. — Cattle represent one of the chief sources of wealth possessed by the State of Minas Geraes. In 1920, 1 278 444 kg. more meat were exported than in the preceding year. There are in the country over 60 factories for the preparation of "xarque" (dried beef), and the annual output is estimated at 9 million kg.

The "Instituto Oswaldo Cruz" has supplied a vaccine which has practically stamped out symptomatic anthrax (*manqueira*). At present, measures are being adopted for the prevention and control of foot-and mouth-disease, and a State Veterinary Service is in process of organisation. The serum for swine fever is prepared at Bello Horizonte by Messrs Aristides and Co.; in 1920 as many as 22 500 doses were sold. The Instituto Oswaldo Cruz prepares a serum for immunising calves against "pesta de manqueira" and distributed 419 800 doses in 1920, and 359 945 during the first 4 months of 1921. A branch of this Institute, at Bello Horizonte, has been entrusted with the Antiophidian Service. It has begun a careful systematic study of the snakes of Brazil, and published information, for the guidance of the country-folk, respecting the poisonous and non-poisonous species. The Institute also prepares and distributes a serum which is an antidote to snake-venom.

With a view to combating piroplasmosis, the Government offers prizes to the 2 first stock-breeders constructing tanks for dipping cattle, as arsenic dips are the best means of freeing animals from ticks (the carriers of trypanosomiasis).

The Government further encourages the breeding-industry by providing barbed-wire for enclosures. This is sold at cost price and carriage-free.

In order to promote the laying down of pastures, the Government gives gratuitously, on request, to all agriculturists, seeds of " Capim gordura " (*Panicum minutiflorus* = *Melinis minutiflora*) or " Capim jaraguée " (*Andropogon rufus*) (1) up to the weight of 10 kg., and supplies larger quantities at very low price.

The " postos zootechnicos " (stockbreeding observation Stations) attached to the State " fazendas " and " colonias " have greatly contributed to the more general rearing of good breeds of animals, especially of cattle, horses and pigs.

Owing to the establishment of lard factories, *pig-breeding* is steadily increasing.

Silkworm-rearing is practised to a small extent in the municipalities of Barbacena and São João Nepomucena : some timid attempts in the same direction have also been made elsewhere. The climatic conditions obtaining in the State are eminently suitable to this industry.

1079 - **The Purification of Sewage Water by Activated Sludge and the Bacterial Flora in Sewage thus Purified.** (2) I. COURMONT, P. and ROCHAIX, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 1, pp. 75-78, Paris, January 5, 1920. — II. CAMBIER, R., *Ibid* No. 11, pp 681-684. March 15, 1920. — III DIENERT, F., *Ibid.* No. 12, p. 702, March 22, 1920. — IV. DIÉNERT, F. and GIRAULT, *Ibid* No. 15, pp 899-901. April 12, 1920. — V. COURMONT, P. and ROCHAIX, A., *Ibid.*, No 16, pp. 967-970, April 19, 1920. — VI. COURMONT P., and ROCHAIX, A., *Ibid.* No. 19, pp. 1134-1135, 10, 1920. — VII. DIÉNERT, F., WANDENBULKE, F., and Mdlle LAUNEY, M., *Ibid.* No. 18, pp. 1089-1092. May 3, 1920. — VIII. CAMBIER, R. *Ibid.* No. 23, pp. 1417-1419. June 7, 1920. — IX. CAMBIER, R., *Ibid.* Vol. 171, No. 1, July 5, 1920. — X CAYEL L., *Ibid.* No. 26, pp. 1406-1407. Dec. 27, 1920. — XI. COUMONT, P., ROCHAIX A., and LAUPIN, F., *Ibid* Vol. 173, No. 3, pp. 181-184. July 18, 1921. — XII. DIÉNERT, F., *Ibid.* Vol. 173, No. 3, pp. 184-186. July 18, 1921.

I. — Thanks to the work of FOWLER, ARDERN, and LOCKETT, the chemical pheuomena produced during the purification of sewage with " activated sludge ' are well known. The great reduction in the number of micro-organisms present in sewage-water thus treated has been shown by ARDERN, HATTON, BARTOW (1915), and RUSSELL and BARTOW (1916). The biological nature and the nitrification process was determined by ARDERN and LOCKETT (1915) and RUSSELL and BARTOW (1916). Little trouble has, however, been taken to discover the part played by other micro-organisms, whether as regards the transformation or the destruction of ternary substances, or from the point of view of the breaking up of albuminoid matter, as preparation for action by the nitrifying bacteria present in the sludge.

The object of Messrs COURMONT and ROCHAIX's paper is to confirm the reduction in the number of micro-organisms in water that has been purified and decanted, and to give a preliminary account of the bacterial flora. The conclusions arrived at are as follows: —

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(1) See *R.* Aug. 1921, No. 816. (*Ed.*)

(2) See *R.* Aug 1915, No. 793; May 1919, No 570. Sept. 1920, No. 843; Nov.-Dec. 1920, No 1051. (*Ed.*(

1) The number of micro-organisms in water purified by the activated-sludge method is greatly reduced. In one of the samples examined, the total number fell, after purification, from 202 500 000 per cc. to 67 587, whereas in another sample after treatment it was only 58 600 per cc.

2) All the bacteria in the purified sewage are aerobic forms, no true anaerobic forms being present so that the putrefactive bacteria appear to have been destroyed.

3) Chromogenetic species predominate over non-chromogenetic.

4) The bacterial flora of purified sewage shows little variation and is reduced to a few species.

5) The purified sewage appears to contain no *B. coli*, or any other typical pathogenic species.

II. — Sewage sludge, when alternately aerated, and then allowed to settle, gradually acquires the property of purifying the sewage with which it comes in contact, in the presence of air. It is generally supposed that this purifying action proceeds in a manner similar to nitric fermentation.

M. CAMBIER has investigated the rate of nitrification, and gives the results of some of his experiments. One drop of sewage-water containing 32 mgm. of ammoniacal nitrogen, and no nitric acid, after having been aerated for 18 hours in contact with activated sludge contained hardly any traces of ammoniacal nitrogen, and 23 mgm. per litre of nitric nitrogen. A similar result was obtained with 2 other muds.

The chief point is the disappearance of a large proportion of the ammonia from the sewage-water after it has been in contact with the sludge for a few minutes, although the amount of nitric acid produced is little or nothing.

This fact is especially noticeable in newly formed sludges and is less marked in old sludges, but in the case of the latter, however short the time of aeration may be, the amount of nitric acid that appears in the liquid is much larger than could be accounted for by the total nitrification of all the ammonia in the untreated water. This addition comes from the combustion of the sludge itself, which in the course of time has become rich in nitrogen compounds.

Even at 0° C. purification is complete and nitrification is only slowed down; at 5° C. the process is completed in 4 hours; it is most rapid at 20°-25° C. and goes on quite satisfactorily at 30° C. At 37° C. which is the optimum temperature for true nitric fermentation, nitric acid is not formed and the sewage-water does not undergo any further change in appearance. Nitric acid only occurs in appreciable quantities when the temperature is *above* 30° C.

Activated sludges can transform nitrites into nitrates at ordinary temperatures: in the presence of chloroform vapour, their activity as regards ammonia ceases.

The author has stated that, if decantation of the mixture of sludge and sewage is deferred for 3 hours, it begins to nitrify rapidly, and that if this purified water is carefully drawn off and the interstitial water removed from the residual sludge by whirling the centrifuge, this water is found to be very poor in nitrates, but to contain on the other hand 10 mgm. of ammonia per litre. Nevertheless if mixed with some fresh sewage, and again aerated, this mud will again purify and nitrify it energetically.

Finally, the colloids present in sewage water are to a large extent, like the ammonia, fixed after the first moments of contact. When after the purifying process was complete, a quantity of ammonia, similar to the amount it first contained, was added to the purified clear water floating on the surface of the mud it was found that colloids were once more present in suspension and the water again assumed the aspect of untreated sewage.

III. — Results obtained by M. DIÉNERT in researches extending, over several years, on the purification of sewage water by means of activated sludges. To obtain activated sludge finely-divided air is blown into the sewage, which is allowed to settle, and fresh sewage is introduced and aerated in the same manner. This process is continued for several days, until the moment arrives when by blowing in air for 5 consecutive hours, it is possible to transform 20 mgm. of ammoniacal nitrogen per litre into nitric or nitrous nitrogen. The time required to attain this result may be called the " activation period " ; its duration depends upon the sewage water used, the amount of air introduced, and the temperature of the water.

In the case of Paris sewage, if the air is blown in for 4 hours each time, this activation period lasted about 2 months; but the time can be shortened by increasing the length of the aeration process each time, or by the addition of carbonate of lime.

Activation is thus produced rather quickly in sewage sludge; it can however be attained in all waters containing similar deposits after a longer or shorter period of treatment.

The process takes place in the same manner as in the case of the introduction of yeast into a sugar, or in the adaptation of organisms to an antiseptic. For a few days the micro-organisms remain inactive and produce no changes in their nutrient medium, then suddenly they become very active and grow rapidly.

IV. — Messrs DIÉNERT and GIRAULT compared the effect of activated sludges from Colombes sewage-water, upon sewage water and ordinary water to which had been added the same amount of ammonia as was present in the sewage. The chief results of these experiments shewed: — 1) That ammonia disappears from sewage and from ordinary water after the same time; 2) That nitric nitrogen only appears after the activated sludge has been at work for some months.

V. — Messrs COURMONT and ROCHAIX have demonstrated, that the effluent from apparatus for purifying sewage by the activated-sludge process contains a much reduced bacterial flora. They could only obtain 7 species from this one effluent but they studied their action upon the albuminoid substances and the nitrogenous compounds that may follow the latter, viz. urea and nitrates.

The proteolytic properties of these micro-organisms are either much reduced or *nil.* All of them except two act upon peptones (indol), but not upon the other albuminoid matters studied. Only *Bacillus subtilis* possesses the power of energetically attacking albuminoid compounds, which it breaks up into simple degradation products.

Only three out of 7 bacteria fermented urea to any extent ; *B. subtilis* possesses this power to a certain degree, but the other 3 are completely inactive.

Five out of 7 of the bacteria present in the purified sewage behave as direct denitrifying organisms, and some of them appear to be very active, judging from their effect upon potassium nitrate.

VI. — Messrs COURMONT and ROCHAIX also studied the action upon carbohydrates of bacteria isolated from the flora of sewage purified by the activated sludge method.

They found that these micro-organisms have a fermenting action upon carbohydrates, which though it varies according to the species, shows that the destruction of ternary products during purification may be due to bacterial activity.

VII. — In order to purify sewage rapidly by means of activated sludge, experience teaches that a certain volume of sludge is necessary. The volume required is about one-third of that of the sewage when measured after standing for 2 hours.

When different amounts of activated sludge were employed, Messrs DIÉNERT, WANDENBULKE and LAUNCY discovered that the proportion between the amount of the ammonia that disappears and the weight of the supposed-dry sludge introduced decreased as the mud increased in quantity.

With the activated-sludge method of purifying sewage-water an ammonia-free, non-putrefactive effluent can be obtained, but owing to the great differences in the composition of sewage, the reduction of the number of bacteria by this process seems necessarily to be very variable.

VIII. — A slight trace of chloroform in the air passed through the mixture of sewage-water and activated sludge is sufficient to prevent the formation of nitrates.

In one of his experiments, M. CAMBIER exposed sewage for 1 hour to a current of air almost saturated with chloroform, and then for 4 hours to a strong current of pure air in order to free the water from all trace of chloroform, after which, it was mixed with very "active" sludge and aerated for 16 hours. The ammonia was fixed, but no nitrification took place.

The experiments made by the author for the purpose of isolating the nitric ferments from the activated sludge gave no positive results.

It thus appears that there are some serious objections to be opposed to the generally-received idea that nitric fermentation takes place during the course of the purification of sewage water by means of activated sludge. It is permissible to believe that the ammonia and other nitrogen compounds in sewage water, which are first fixed by the sludge during the early phase of purification, can later be oxidised and transformed into nitric acid by the oxygen of the air blown into the mass. In a subsequent paper (IX), M. Cambier has shown how this oxidisation is encouraged, if not determined, by the oxidisation of certain substances present in activated sludge, especially sulphide of iron.

IX. — Activated sludges contain a considerable proportion of iron in the form of sulphide, which helps to impart to them their dark colour. When for any reason, their activity begins to decrease or cease, these muds not infrequently assume a reddish hue due to the presence of ferric hydrate. Everything (acidity of surroundings, heat, coagulating agents, etc.), that tends to destroy the iron sulphide, or change its physical condition, also tends to destroy the activity of the mud.

M. Cambier has sought to find out whether the addition of iron sulphide to sludges with little "activity" would not restore their purifying properties or their nitrifying power. He found that the reactivation of the mud exactly coincided with the introduction of iron sulphide, both as regards the fixation of the ammonia and its subsequent nitrification.

He finally observed that sewage-water to which sulphide of iron had been added, in the absence of activated sludge was not purified in any way. Under these conditions, the ammonia is not oxidised by the current of air, although the small amount of sulphide of iron is entirely transformed into ferric hydrate.

X. — M. Cavel attempted to discover whether the transformation of ammonia into nitrous and nitric nitrogen is the work of bacteria. He states that the addition of sludge followed by activation by a current of air brings about the above-mentioned change, even in sewage-water that has been sterilised, either in an autoclave, or by passage through a Chamberland filter.

On sprinkling fresh sludge on slag moistened with "active" sludge, and blowing in air, the activation of the fresh sludge was brought about in 3 days

All these facts seem to show that disappearance of ammonia during the purification of sewage by the activated-sludge method is due to bacteria. The medium in which the preceding experiments were made was alkaline, which is the normal reaction of sewage. If the reaction is changed by the addition of a little acid, the results are no longer the same; no change takes place in the ammonia, the amount present remaining the same, which is in accordance with what we known from Christensen respecting the susceptibility of Nitrobacter to an acid medium.

XI. — Courmont, Rochaix and Laupin who studied from the hygienic standpoint the bacilli of the typhus and paratyphus groups, and the vibrion of cholera, have reached the following conclusions:—

1) At the termination of the chemical purification (which was always after 6 hours in their experiments), the pathogenic micro-organisms of the typhus-paratyphus groups were nearly always present in the effluent, but the cholera vibrion had disappeared.

2) The late disappearance of the typhus and paratyphus bacilli, and cholera vibrion, do not seem to depend on aeration in the presence of

activated sludge, but essentially upon the active competition of other micro-organisms.

XII. — Because town sewage is mixed with industrial waste water, which contains many antiseptic substances, M. DIÉNERT has studied the effect of certain antiseptics used in England and America for purifying the sewage of cities, upon the activated sludge.

If 3 parts of sewage-water containing 0.5 % carbolic acid are added to 1 part of activated sludge, and air is bubbled through the mixture, the ammonia and carbolic acid disappear slowly, but without any formation of either nitrous or nitric acid.

If instead of adding carbolic acid to the water in the first place, the antiseptic is introduced during the course of nitric fermentation, this is arrested and the ammonia continues to disappear but much more slowly, and without leaving any traces.

When carbolic acid is added to sewage-water that has been wholly freed from ammonia by nitrification, and nitrous acid is introduced, the latter is transformed into nitric acid with the same rapidity as if no carbolic acid were present. This antiseptic only prevents nitrous fermentation. As soon as the carbolic acid is removed by a current of air, the latter pro cess begins once more. Nitric fermentation is not affected by weak doses of carbolic acid.

The ammonia that disappears from the sewage-water owing to the action of activated sludge, in the presence of carbolic acid, vanishes, without leaving any traces, either in the water or the mud.

If carbolic acid is allowed to act upon activated mineral powders, expecially on pure manganese dioxide obtained from the nitrate, the same results are obtained as in the case of activated sewage mud. Should pure untreated $Mn O_2$ (whether sterilised or not) be substituted for the activated $Mn O_2$, air can be blown through it for 15 days without any of the ammonia disappearing.

These experiments prove that activated $Mn O_2$ oxidises the ammonia when under the influence of bacterial action. Since in the author's experiments, the bacterial action of activated $Mn O_2$ was precisely similar to that of the activated sludge of sewage water, he thinks he may safely state that the bacterial nature of nitric fermentation may be considered absolutely proved.

As regards the loss of the ammonia which is not found again in the form of nitrous, nitric, or ammoniacal nitrogen in the mud, or sewagewater, this is not an absorption phenomenon, but appears also to be due to bacterial action.

1080 - **Pellagra in Lombardy and Tridentine Venetia Since 1900.** — DEVOTO, L., in the *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Third series, Vol. LIV, Parts VI-X, pp. 239-242. Milan, 1921.

Cases of pellagra, which were still very numerous both in Lombardy and the Province of Trent during the last forty years of the past century, began to decrease with the beginning of the new century, and continued to become rarer, even during the war, so that it may now be stated that this disease, which has existed in Italy for over two hundred years, has at last completely disappeared, and its re-occurrence will be prevented by careful supervision

In 1899, there were still about 40 000 cases of pellagra in Lombardy, and 10 000 in the Province of Trent. In 1920, not a single case of the disease was to be found in either, so that the Hospitals for patients suffering from pellagra in Rovereto and Inzago, respectively, have altered their names, and are used for other purposes.

The Italian anti-pellagra legislation (which was immediately adopted and applied by Austria to the Province of Trent) was based on the work of CESARE LOMBROSO, who demonstrated that the disease was due to the use of spoiled, mouldy maize. Though there are still some points that remain obscure respecting the complicated connection between maize and pellagra, it is nevertheless true that the results of Italian legislation are the best confirmation of the truth of the discoveries of LOMBROSO, and his school, to which the author belongs.

LOMBROSO's work should, in the author's opinion, be completed at the present time in the following manner. — *Practically*, by observing whether the use of sound maize can cause a recrudescence of the malady in persons who have formerly suffered from pellagra, or aggravate it in the case of patients in whom it is clearly developing; *Theorically*, by determining whether the intense and prolonged use of sound maize can be the origin of the disease.

1081 - **The Institution of a Laboratory for Scientific Research in Galicia, Spain.** — *Fl Cultivador moderno*, Year XI, No. 8, p. 12. Barcelona, August 1921.

The *Junta por Ampliación de Estudios* (Commission for the Development of Study) has instituted a Laboratory of Scientific Research in Galicia. This Laboratory is intended to devote its attention to the study of matters relating to agriculture, horticulture, stock-breeding, fish-rearing, etc. The Institute is installed on the premises occupied by the Veterinary College of Santiago.

The same Commission has intrusted to M. CRUZ GALLÁSTEGUI (who has studied the methods adopted in the United States) the work connected with the selection of maize.

CROPS AND CULTIVATION

1082 - **Temperature Survey and Length of Growing Season in the Salt River Valley, Arizona, U. S.** — GORDON, J H., in *Monthly Weather Review*, Vol. 49, No. 5, pp. 271-274, graph 1, figs. 2. Washington, May 1921.

The completion of the Roosevelt Dam and distributing canals in the Salt River Valley early in 1911, marked the beginning of an era of rapid development of the section round Phoenix (Arizona).

Large plantations of citrus fruits, sugar cane and sugar beets were made, and decidedly important cultural tests were conducted, including the growing of figs, vines, olives, dates, cotton and several other crops.

The winters of 1911-12, and 1912-13 were unusually severe, putting to a serious test the experiments in hand. Need was felt for a more definite knowledge of atmospheric conditions in order to make it possible to take the necessary steps to arrive at a rational adaptation of crops to prevailing climatic conditions.

The work was started in the autumn of 1913 by R. R. BRIGGS " to determine the area and limits within which the highest money value crops could be grown. "

Upon the basis of records kept up till the end of the survey in 1919-20, it was found possible to prepare a map of the area showing the isotherms and the length of the growing season. There has already been a wide demand for this map which has helped the growers in the choice of the best locations for citrus plantations, etc.

Surveys were made with the use of ordinary thermometers and thermographs at 42 stations

TEMPERATURE RECORDS. — The average minimum temperatures for December and January were taken, owing to the fact that these were the coldest months of the year and also because for these months more complete figures were available. It has not been found possible to utilise the records from all the stations, as in some cases they were too short to give a fair mean; those utilised however included records made in areas covering periods of 16 to 25 years, which have given ample opportunity for the summing up and control of the data collected during the surveys from 1913-20.

The mean minimum temperatures do not however particularly interest the farmers; the most vital question is to become acquainted with the absolute low temperatures which may prove fatal to certain crops.

The relationship however between these temperatures and the mean minimum is very close, with a difference almost constant of about 11° F. This is shown in Table I.

TABLE I. — *Comparison of mean minimum and absolute minimum temperatures.*

Station	Record period	Mean minimum temperature	Mean absolute minimum temperature	Difference
	Years	°F	°F	
Granite Reef Dam	21	40.0	28.8	11.2
Phoenix weather Bureau	25	38.5	28.0	— 10.5
Phoenix nº 2	6	37.5	26.6	— 10.9
Gould's Ranch	5	37.0	25.8	— 11.2
Mesa	18	36.0	25.4	— 10.6
Higley	5	36.0	24,8	— 11.2
Tempe.	15	35.0	24.4	— 10.6
Phoenix nº 1	18	34.5	23.4	— 11.1
Chandler	6	33.0	23.1	— 9.9
Average difference	—			— 10.8

Not only will the temperature map enable the farmer to make a wise choice of locality the least liable to frost attack, but it may also be used, with the necessary alterations, in the forecasting of frost.

LENGTH OF THE GROWING SEASON. — The Phoenix Weather Bureau serves as a base with temperature of 38.5° F, and 288 days as the average length of the growing season.

TABLE II. — *Length of the growing season.*

Stations	Record period	Mean minimum temperature	Season as compared with Phœnix
	Years	°F	*Days*
Granite Reef Dam	16	40.0	+ 5.0
Phœnix weather Bureau	25	38.5	0.0
Phœnix n° 2.	5	37.5	— 1.2
Gould's Ranch	5	37.0	— 2.8
Mesa	11	36.0	— 17.5
Higley	5	36.0	— 18.5
Tempe	14	35.0	— 19.0
Phœnix n° 1	11	34.5	— 22.0
Chandler	5	33.0	— 31.0

Temperature maps such as those described in the present article may serve a very valuable purpose, not only for the grower, but also for the health seeker, as they contribute to a wider knowledge of the climatic conditions prevailing in various districts from the bio-geographical standpoint.

1083 - **Investigations Concerning the Critical Period of Wheat at College Park, Maryland, U. S.** — SANDO, W. I., in *Monthly Weather Review*, Vol. 49, No 5, p. 301. Washington, May 1921.

During the autumn of 1920, a careful study for the purpose of ascertaining the relation of climate to the yield of wheat was undertaken at the Maryland Agricultural Experiment Station at College Park. Four varieties of wheat were observed. The records cover a period of 12 years.

Correlation coefficients for temperature and rainfall for each month of the growing period were determined for each variety.

A significant negative correlation was found between rainfall and yield for March and May, but was not evident between temperature and yield.

Other factors were also investigated, but further study will be necessary before their actual relation to yield can be determined.

1084 - How to Forecast the Total Yield of Cotton from Weather Records in November.

— KINCER, J. B., in *Monthly Weather Review*, Vol. 49. No. 5, pp. 295-299. Washington. May 1921.

On the following dates, viz. :—

September 1 — September 25 — October 15 — November 1 — November 14 — December 1 — December 13 — January 1 — January 16 and March 21, the Bureau of the Census, Department of Commerce U. S., issues a succession of reports on the harvest or ginning of the cotton crop, followed by a final report showing the total production (1).

In the present case, the author gives the results of a study to establish: 1) the relation between the weather conditions and the amount of cotton ginned between November 1 and December 1 (the two earliest periods of the harvest season); 2) the relation between the cotton ginned up till the end of November and the total output.

The calculations are made with reference to the 15-year period 1905-19 and concern the 10 Cotton-belt States: North Carolina, South Carolina, Georgia, Alabama, Mississipi, Louisiana, Tennessee, Arkansas, Oklahoma and Texas.

The frequency of the rainfall and the amount of cloudy weather are very closely associated to a negative degree with the cotton harvested or ginned in a given period. In the course of his investigations, the author refers to the average number of cloudy and rainy days in November.

During the period in question, the average annual cotton production was, in round numbers, 12 340 000 running bales (2); the average number of bales ginned prior to November 1 was 7 788 000 (63 % of the total crop); the average amount unginned on November 1 was 4 553 000 bales, 57 % of which was ginned during November. This latter percentage varied greatly from year to year, depending on atmospheric conditions, either favourable or unfavourable for picking and ginning, and in very close relation, as previously mentioned, with the frequency of rain and clouds.

With a knowledge: —

A) Of the actual amount of cotton ginned during November (as indicated in the Bureau of Census reports for November 14 and December) ;

B) Of the percentage relation between this amount and the total remaining unginned on November 1 (as calculated from the weather records), the quotient obtained by dividing *A* by *B* gives an indication of the actual total remaining unginned By adding to this the amount ginned prior to November, the computation for the total yearly crop is established.

A study of the prevailing weather in November would permit the forecasting of the yield of cotton some months in advance of the harvest.

A series of tables is given for the 10 states in the Cotton belt.

In North Carolina the rainy days were in 1905, 4 and the number of cloudy days 8.

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(1) See *R.* June 1918, No. 622. (*Ed.*)

(2) *Running bale* = bale of 500 lb. (*Ed.*)

In view of the fact that wide variations exist in the amount of cottons harvested in the respective States, the averages of meteorological data obviously could not logically be combined on an equal basis for the purpose of correlation with the ginning reports.

To establish a more reliable comparison ratio, the meteorological value of each State is multiplied by the amount of cotton ginned in November, expressed in % of the total quantity of ginned cotton in the 10 afore-mentioned States, and the value obtained is then divided by 10 (See Table I).

If the correlation coefficient between these percentages and the average number of rainy and cloudy days (as shown in the last right-hand column of Table II : 7.2 ; 6.3 ; 9.3 etc.) is calculated, using the generally recognised formula, the result will be − 0.91 ± 0.03, a distinctly high negative correlation coefficient. The percentage of cotton produced and ginned should therefore be all the less when the number ot rainy and cloudy days is high.

The letter r indicates the number of rainy days and y the quantity of cotton ginned in November and expressed in % of the total amount of unginned cotton on November 1.

The preparation of a dot chart to determine the relation existing between the 2 quantities, shews that the dots dispose themselves diagonally across the chart with a considerable uniformity of arrangement and that a very clearly definited straight line relation exists. (See annexed graph).

TABLE I. — *Computations of the Cotton ginned during November* 1905-1919, *in % of total amount of unginned cotton on November* 1.

1905	55.3%	1909	60.9%	1913	63.2%	1917	62.2%
1906	51.4	1910	66.2	1914	53.4	1918	43.4
1907	44.9	1911	51.0	1915	63.0	1919	50.6
1908	57.6	1912	64.6	1916	63.1		—

The dot chart, indicates that the constants of the oblique line in the figure (which fits bests to the data in hand) may be determined by the equation $y = a + br$ with only 2 unknown quantities.

Table III shows the constants of the equation (r, y, r^2, ry).

The following series of equations is forthcoming. (n = number of years, etc).

$$y = a + br \quad \ldots\ldots\ldots\ldots\ldots \quad \text{I}$$

$$b = \frac{n\ (\Sigma\ ry) - (\Sigma\ r)\ (\Sigma\ y)}{n\ (\Sigma\ r^2) - (\Sigma\ r)^2}$$

$$a = \frac{\Sigma\ y - b\ (\Sigma\ r)}{n}$$

TABLE II. — *Mean of cloudy and rainy days according to percentage ratio of cotton ginned during November.*

Year	orth Carolin	uth Carolin	Georgia	Alabama	Mississippi	Louisiana	Tennessee	Arkansas	Oklahoma	Texas	Total	Average for Cotton-belt
1905	4.8	5.0	8.4	8.0	10.2	3.8	3.0	7.0	4.0	18.0	72.2	7.2
1906	2.8	3.5	5.2	6.5	7.2	2.4	3.6	7.5	8.1	16.2	63.0	6.3
1907	8.0	10.5	15.4	10.5	10.8	3.8	4.2	7.5	4.5	18.0	98.2	9.3
1908	3.2	3.5	9.1	6.5	7.8	3.0	3.6	8.5	5.0	11.4	61.6	6.2
1909	3.2	3.0	4.2	3.5	6.0	2.2	2.6	8.0	7.6	14.2	54.5	5.4
1910	3.2	4.0	7.7	7.0	8.4	2.8	3.0	4.0	1.8	8.6	50.5	5.0
1911	7.6	10.5	14.0	10.5	10.2	3.4	5.4	7.5	5.0	13.3	87.4	8.7
1912	3.6	4.0	6.3	4.5	6.0	2.2	2.4	3.0	2.2	7.6	41.8	4.2
1913	2.8	3.0	5.6	3.5	5.4	2.2	3.6	8.0	8.6	17.1	59.8	6.0
1914	5.2	6.5	9.1	7.5	9.6	3.6	4.0	6.5	3.2	16.2	71.4	7.1
1915	4.0	4.0	5.6	5.5	7.8	2.2	3.8	7.5	2.2	6.6	49.2	4.9
1916	4.8	5.5	7.7	5.5	6.0	1.4	2.6	5.5	4.0	7.6	50.6	5.1
1917	4.4	4.5	5.6	4.5	6.6	1.2	3.4	6.5	4.5	4.8	46.0	4.6
1918	4.8	8.0	11.9	8.0	9.6	3.6	4.0	8.5	6.8	18.0	83.2	8.3
1919	4.8	4.5	9.8	7.5	10.8	3.2	4.2	8.5	6.3	13.3	72.9	7.3
Average	202	254	355	243	299	104	92	236	223	484	2492	
Percentages . . .	8	10	14	10	12	—	4	10	9	19	100	

Substituting in equation 2 gives :

$$b = \frac{15\ (5\,276.0) - (95.6 \times 850.8)}{15\ (643.7) - (95.6)^2} = \frac{-21\,965}{516.1} = -\ 4.26.$$

Substituting in equation 3 gives :

$$a = \frac{850.8 - (-\,4.26 \times 95.6)}{15} = \frac{1258.1}{15} = 83.9.$$

The application of these constants to the weather data grouped under r in Table III permits the computations for y for each year.

Column 1 : Amount of cotton ginned during November :

Column 2 : Computed percentage of cotton remaining to be ginned on November 1, that was to be ginned during November (computed from equations in Table III applied to weather data).

Column 3 : Computed amount remaining unginned on November 1 (*Column* 1 divided by *Column* 2).

Column 4 : Amount ginned prior to November 1.

Column 5 : Computed total crop (Column 3 + Column 4).

Column 6 : Total crop as reported by the Bureau of Census.

Column 7 : percentage of error in computed amount.

Dot chart showing the relation between the number of rainy and cloudy days in November and the percentage of cotton remaining to be ginned in November, that was ginned during November.

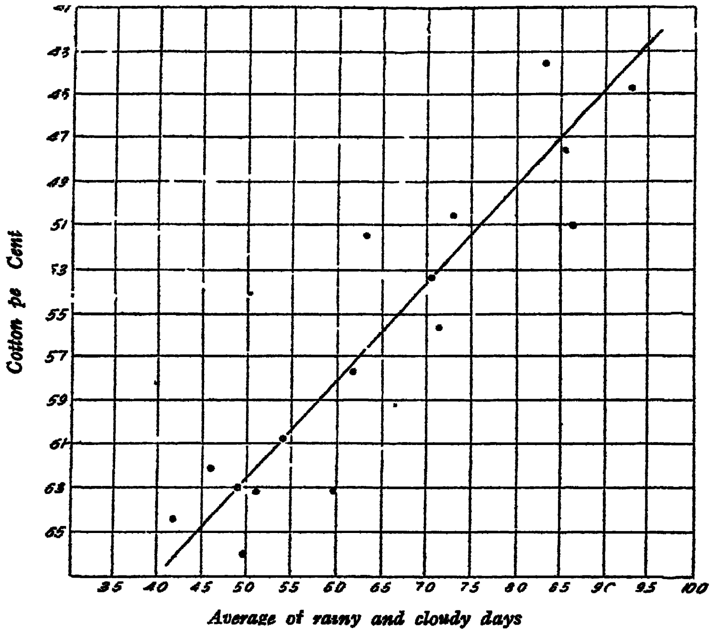

TABLE III.

	r	y	r^2	ry
1905	7.2	55.3	51.6	398.2
1906	6.3	51.4	39.7	323.8
1907	9.3	44.9	86.5	417.6
1908	6.2	57.6	38.4	357.1
1909	5.4	60.9	29.2	328.9
1910	5.0	66.2	25.0	331.0
1911	8.7	51.0	75.7	443.7
1912	4.2	64.6	17.6	271.3
1913	6.0	63.2	36.0	379.2
1914	7.1	53.4	50.4	379.1
1915	4.9	63.0	24.0	308.7
1916	5.1	63.1	26.0	321.8
1917	4.6	62.2	21.2	286.1
1918	8.3	43.4	68.9	360.2
1919	7.3	50.6	53.3	369.3
Sums . .	**95.6**	**850.8**	**643.7**	**5276.0**

TABLE IV. — *Computation of the total cotton production by the application of the constants of the equation of the straight line (shown in Table III) to the weather data and ginning reports for November.*

1905	2,232	53.2	4,195	6,458	10,653	10,495	+ 1.5
1906	3,122	57.1	5,468	6,906	12,374	12,983	— 4.7
1907	2,214	44.3	4,998	6,129	11,127	11,058	+ 0.6
1908	2,817	57.5	4,899	8,192	13,091	13,086	± 0.0
1909	1,859	60.9	3,053	7,018	10,071	10,073	± 0.0
1910	2,794	62.6	4,463	7,346	11,809	11,568	+ 2.1
1911	2,846	46.8	6,081	9,971	16,052	15,553	+ 3.2
1912	2,986	66.0	4,524	8,869	13,393	13,489	— 0.7
1913	3,258	58.3	5,588	8,830	14,418	13,983	+ 3.1
1914	3,246	53.7	6,045	9,827	15,872	15,906	+ 0.2
1915	2,325	63 0	3,690	7,349	11,069	11,068	± 0.0
1916	1,728	62.2	2,778	8,624	11,402	11,364	+ 0.3
1917	2,529	64.3	3,933	7,185	11,118	11,248	— 1.2
1918	1,794	48.5	3,699	7,777	11,474	11,906	— 3.6
1919	2,539	52.8	4,809	6,305	11,114	11,326	
Average	—	—	—	—	—	—	1,5

It is therefore clearly demonstrated that by means of data concerning the cotton yield in November and weather data for the same month, it is possible to calculate to a large extent the final output.

1085 - **Nicolaidi Sacks, a Protection Against White Frosts in Spring** (1). — I. PARESCHI in the *Giornale di Agricoltura della Domenica*, Vol. XXXI, No. 12, pp. 20. Piacenza, March 20, 1921. — II. CALZONI, A., in the *Rivista di Ampelografia*, Vol. II, No. 7, pp. 99-101. Alba-Livorno, July 1, 1921.

I and II. — NICOLAIDI sacks (Magia brand) are filled with thread ravellings, tar and fatty substances. In burning they produce columns of very thick smoke that hang above the ground for half an hour or longer. The smoke may extend over on area of 2-3 hectares, but it is quite innocuous. These sacks can be used in the open, if they are put upon a stand made of 4 branches in the form of a cross, and covered with tarred paper. They are lighted very rapidly and simply by a friction fuse with which each sack is provided. These sacks ought not to be expensive, for they are filled with the waste products of certain industries, and in any case, seeing that the injury wrought by a white frost may affect the harvest of 2 or 3 successive years, the money spent on this protective device is certainly of little importance.

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(1) For the use of smoke-generating candles for the same purpose, see *R.* April 1921, No. 365. (*Ed.*)

1086 - **Colloidal Clay in Agricultural Soil.** — De Angelis D'Ossat, G., in the *Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 4-6, pp. 214-224. Modena, 1921.

The author gives an account of the experiments carried out on this subject by various investigators, and shows wherein he differs from some of their conclusions. He then describes his own researches, and states that, from the results of his work and that of others, he has arrived at the conclusion that clay may be regarded as a zeolitic substance or one of very similar nature which cannot by means of the swelling of its colloidal elements act upon the fundamental structural characters of the soil to the point of reducing the distance between the particles beyond the lowest limit (0.000,05 mm.) established by Quincke for molecular action. On the other hand, from the physical and chemical facts determined experimentally by several mineralogists (Zambonini, etc.), it seems reasonable to suppose that zeolites may have a micellar structure similar to that of colloids. Clay, being hydrated in the same way as zeolites, takes up water by capillarity and adsorption (molecular) which renders it impermeable to other water, as occurs in the case of crystalline substances of a similar nature.

The chief factors bringing about changes in clay are heat and pressure; the action of heat may be subdivided under the following heads:— Temperature, evaporation, insolation, congelation. In the case of rocks, it is necessary, as far as possible, to regard pressure as distinct from thermic action.

The author considers the effect of each of those factors separately, and concludes that the alterations they cause in the colloidal clay are responsible for the different properties of rocks and agricultural soils.

Colloidal clay takes up water by capillary and molecular imbibition, and may lose it again, wholly or in part, through evaporation and dehydration. In the first case, the colloidal clay becomes impermeable to external water and to gases, in the second, it once more becomes permeable to both. The two cases correspond to the two typical structures of Wollny and Hilgard, and as the author says, to explain them it is quite unnecessary to have recourse to hypotheses which are not supported by any of the current views respecting colloids.

The changes taking place in colloidal clay as a result of the combined action of heat and pressure, sufficiently account for all the physical properties of clay soils, and their relation to productivity.

1087 - **Ammonia-Absorbing Capacity of Soils.**— Petit, A., in the *Annales de la Science agronomique*, Year 38, Series 6, No. 1, pp. 20-35. Paris, January-February 1921,

It is often maintained that lime must be present for the soil to be able to fix alkaline bases combined with strong acids . Were this the case, acid soils like those of moors, would be incapable of retaining ammonia, or the potash from fertilisers containing mineral salts. A certain number of experiments have however shown that this assertion is somewhat too sweeping.

The question is one of great interest to horticulturists, who use moor-soil for so-called lime-shunning plants. The author has also begun to study the question, and has taken the opportunity of determining how far different factors affect the ammonia-absorbing capacity of soils.

In his experiments he used:— 1) Moorland soil composed of siliceous sand and decomposing vegetable matter, and having a distinctly acid reaction; 2) crude kaolin, only passed through a sieve with meshes of 1 mm., which when damp turned litmus red. Those substances were free from lime. At the beginning of the experiments, the moor soil contained some ammonia; the amount increasing with the course of time.

The results, which were not always in accordance with received opinions, were as follows:—

1) Moor soil readily yields up its ammonia to water, and the process is encouraged by the presence of different salts used as fertilisers, such as potassium chloride, sodium nitrate and lime.

2) Moor soil and kaolin, which are both lime-free, and have an acid reaction, are nevertheless capable of fixing ammonia combined with sulphuric acid, but this power is partly masked in the case of moor soil by the ammonia the latter gives up to water.

3) Treatment with hydrochloric acid does not deprive either moor soil or kaolin of their power of absorbing ammonia combined with sulphuric acid.

4) The addition of lime only slightly increases the capacity for absorbing ammonia combined with sulphuric acid in the case of the moor soil, and has no such effect for the kaolin.

5) The addition of lime decreases the free ammonia fixing capacity of both moor-soil and kaolin.

6) When the moor soil has no ammonia to give up to the water, weak ammoniacal salt solutions are more impoverished by its absorbent power than concentrated solutions.

7) The fraction of ammonia that is fixed decreases when the volume of the salt solution is increased, and diminishes when the weight of soil taken is augmented.

1088 - The Nature of Soil Acidity with Regard to Its Quantitative Determination. —

MACINTIRE, W. H. (University of Tennessee Agricultural Experiment Station, Knoxville, Tenn.), in *Journal of the American Society of Agronomy*, Vol. 13, No. 4, pp. 137-161, bibliography of 74 publications. Lancaster, Pa. April, 1921.

In recent years no one phase of soil chemistry has received more attention than the problem variously referred to as lime requirement, soil acidity or lime absorption coefficient. The problem can hardly be considered however as having solely a chemical or physico-chemical basis in its relation to soil fertility, for it is closely correlated with, if not inseparable from, both bacteriological and plant physiological considerations. Until very recently, if even now, little effort has been made or opportunity offered for concerted authentic action to clarify this intricate problem and to adopt terms or phrases which convey a definite and accepted meaning for the several possible causes and the possible differential intensities of the reactions responsible for the soil condition known most commonly as acid. In the past, the study of so-called "soil acidity" took direction largely from the isolated and academic viewpoint of the laboratory worker seeking to establish reactions and to determine their speed and extent. Nevertheless in much of the more recent work, special emphasis has been placed upon correlations with bacterial and plant-response factors. It is the purpose of this paper to offer briefly the chronological development of most of the viewpoints and hypotheses advanced and conclusions maintained, with or without subsequent modification, by those who have reported upon this topic.

As to mucks and peats poor in alkali and alkali-earth bases the acidity cannot be considered on the same basis as rock-derived soils. The organic contents of peats and mucks possess acid, or base fixing, properties. It is a moot point whether such acidity is caused by adsorption or by true acids.

Considering rock-derived soils it may be concluded:

1) Although salts of a number of organic acids have been isolated from soils, no one definite free organic acid has ever been extracted, If all of the organic carbon in many soils was considered as being a constituent of a definite organic acid, the hypothetical acid so calculated would be equivalent to only a fraction of the amount of acidity determined by different methods of procedure.

2) In practice, certain salts produce a decrease of soil acidity (sodium nitrate, potassium nitrate, etc.) though in the laboratory treatments during short periods followed by extractions, the reverse may be true, while the addition of certain other neutral salts produced an increase in acidity in both laboratory and field, due to removal of native bases or amphoteric elements.

3) Removal or adsorption of dissolved bases by soils appeared to be a chemical function of acid silicates, principally alumino-silicates, the extent of whose hydration is a controlling factor in initial intensity and continuity of reaction. The acidity of soils is, in the main, induced by the loss of calcic and magnesic inorganic salts, derived originally from the hydrolysis of the alkali-earth siliceous complexes, thereby increasing the acid properties or amount of acid silicates.

4) Where the base and its combined radical are added in water solutions to soils, and in equivalence, with reference both to mass and degree of dissociation, the adsorption of basic ions may be considered as of near equivalence. But when alkali-earth carbonates (calcium and magnesium carbonates) are subjected to moist and intimate contact with acid soils, the active masses will vary in amount and degree of dissociation, while the precipitated products of the reactions will vary in their solubility, or tendency toward reversion through hydrolysis and recarbonation; hence, the difference in attaining and maintaining equilibria and the disparity in the extent of the reactions, which will vary markedly from chemical equivalence in a given time.

5) Silicic acid in mass will progressively hydrolyse and continue to decompose calcium and magnesium carbonate when the liberated car-

bonic acid is removed from solution. This acid will pass from the solid to solution phase yielding hydrogen-ion concentration and is capable of effecting an inversion of cane sugar.

6) After intense alkali treatments and the removal of excess of hydrates and after intense heating, pure silica, silicates, and titanium oxide will, on the addition of water, hydrolyse and act as acids towards the alkali-earth bases.

7) Many acid soils will yield aqueous extracts, alkaline to some of the common indicators, but showing hydrogen-ion concentration by electrometric or colorimetric methods. The hydrogen-ion concentrations of acid soils are not generally considered as being of such intensity as to be of direct detriment to higher plant life, though they may affect the growth of bacteria and fungi.

8) The injurious effect of acidity may be attributed in some instances to aluminum and other toxic salts, but, in general, more particularly to the diminished supply of available calcium from the depleted lime content of the soil, as influencing the adaptability of the media for biological development and the meagreness of the lime as plant food, or as an essential regulatory component of the plant juice.

9) The formation of organic acids and the generation of mineral acids, such as nitric, in soils may be conceded; but their occurrence within the soil seems to be of but brief duration, because of neutralization by native or applied basic materials.

10) The reactions between soils and alkali-earth carbonates are characterized by a more intense initial activity, with a continued and lesser intensity extending over a long period of time. Such variations have been attributed to different acids, of active and less active " avidity ", or to the greater immediate solubility and the lesser progressive solubility of silicic acid and its acid salts. An excess of basic carbonates may occur in a soil possessing slow reacting but potential, acidity, in the form of slowly hydrolysing and ionizing silicic acids and their hydrogen salts.

11) Finally, though it is not unanimously agreed, it seems to be the view of the majority that the laboratory determination of a soil's tendency to absorb, fix or neutralize lime is an academic consideration, without any definitely established quantitative correlation with field practice.

1089 - **Researches upon the Protozoa found in the Water of the River Tessin (Italy)- and the Lands Watered by it.** — COPPA, A., in the *Stazioni sperimentali agrarie italiane*, Vol. LVI, parts 4-6, pp. 181-213, 5 figs., bibliography of 17 publications. Modena, 1921.

The author has studied the protozoas to be found in the rice and " marcita " fields in the neighbourhood of Pezzana and Gravellone (near Pavia), and also in soils growing strawberries, heather, zinnias and haricots (in the Botanical Garden at Pavia), specimens being taken each month from February 1919 to the end of March 1920. He has discovered a total of 62 species, the majority were encysted, but living cultures were made in the laboratory. Heat and food are the most important factors in bringing about the de-encysting of these protozoa.

The geological nature of the soil has a certain influence in unicellular life. Soils in which silicates predominate are far more favourable than calcareous soils, particularly as regards actual numbers. Different types of fertilisers have no particular influence on the protozoon fauna. Temperature and osmotic pressure, calculated experimentally for various conditions and for various solutions of fertilisers are not sufficiently potent influences to permit the establishment of a facies of protozoa with definite characteristics for their various habitats. It is only possible to attribute definite characteristics to the types found in the rice-fields. Water is the main determining factor; as a matter of fact the 17 varieties belonging exclusively to the rice-fields (*Amoeba beryllifera, Difflugia acuminata, D. lobostoma, D. coronata, D. fallax, Lequereusia modesta, Arcella vulgaris, Arcella costata, Centropyxis aculeata, Volvox globator, Coleps hirtus, Spirostomun teres, Opisthodon niemeccensis, Loxodes rostrum, Urostyla weissii*) were found by Madam COPPA or other workers in fresh water.

Protozoa are conveyed in soils by passive agencies, among which water is the most important, being at the same time particularly favourable to their development.

The number of species of protozoa in the waters about Pavia discovered by the author in a year is 63. Of these three presented particular characteristics, not hitherto recorded by previous writers on the subject.

The author ascertained that the maximum development of unicellular life takes place in the Summer (June) and the minimum in Autumn (October).

Of the classified species, 35 are common to water and soil. Among these the Rhizopods occupy the first place. The majority of the aquatic forms observed in the soil belong to lands irrigated or submerged during a great part of the years, that is to say, in the water-meadows and ricefields.

Speaking generally there cannot be said to be any difference in the time when the same species make their appearance in different localities.

The varieties of protozoa in the Pavia district are essentially cosmopolitan. Certain species (*Ceratium hirundinella, Peridinium tabulatum*) exhibit seasonal variations.

1090 – **The Plough as a Means of Making Gradually Sloping Terraces.** — GIANNOBI, I. in *Il Coltivatore*, year 67, No. 23, pp. 133-138, 6 figs. Casale Monferrato, Aug. 20, 1921.

The author has made a study of a method of terracing (starting with a plantation at the outside) devised to avoid as far as possible the difficulties of the system which consists in cutting the hills across by rows of vines and by ploughing transversely between the rows. With this method, since the soil is constantly being turned from above, there is a gradual terracing of the slope, leaving between each pair of terraces a smaller level in which the rows of vines will have to grow. The general conditions are not, however, favourable. If the slope faces north the soil raised against the row will keep it in continual shade ; if it faces south, the exposure below the row with increase the already high evaporation in the soil ; in clay or clay-loam soils, during the early years of the plantation, water will lodge in the trenched soil ; finally a somewhat extensive area will be unavailable for the usual herbaceous crops.

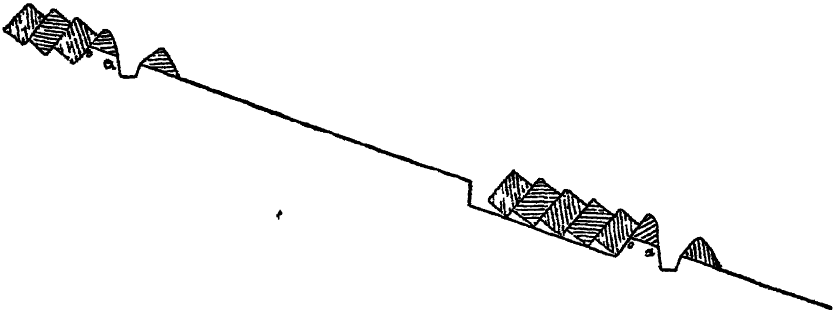

Fig. 1

The following method is suggested by the author to overcome these difficulties :

First, the surface of the hill, is divided transversely into sections of such breadth as will allow, when the terracing is complete, for a depth of slope not exceeding two metres.

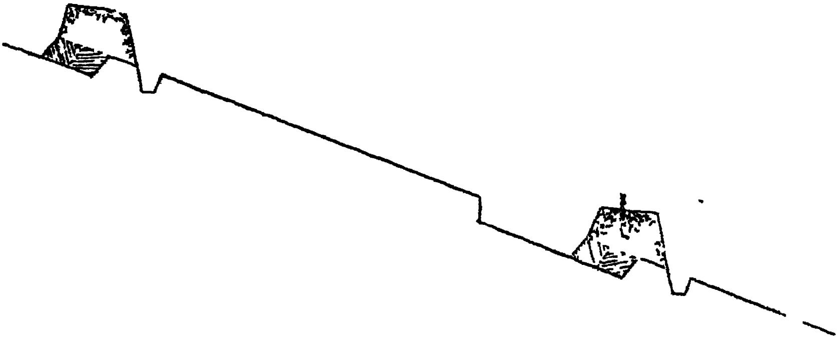

Fig. 2

The first furrow is cut by the plough immediately below the dividing line of each section (i. e. below point *a*, fig. 1). Other furrows follow the first above this line, leaving however intact the part *oa* (fig. 1) about 40 centimetres wide, to serve as a support for the slope of the turned soil. The number of these furrows should be such that the displaced soil, added to that from the first furrow below point *a* should be sufficient to form a more or less trapezoidal mound about 1.20 metres wide at the base and 60 cm. at the top, with a depth of about 30 cm. less than that which the terrace should have when finally established.

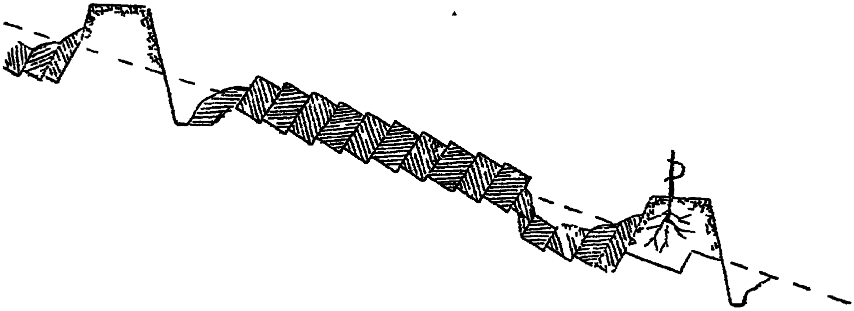

FIG. 3

The remainder of the ground, including that in which the furrows have been cut for the formation of the mound, will be worked in the ordinary way with a turnwrest plough as for the usual herbaceous crops. Afterwards, if time allows, cuttings or slips can be planted in the mound.

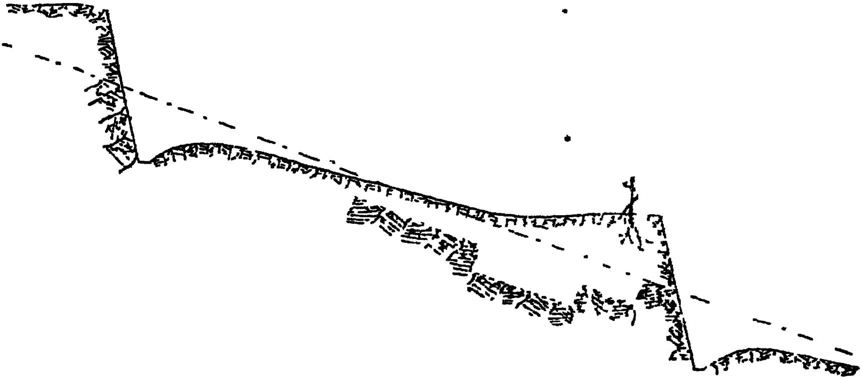

FIG. 4

The profile will then be as shewn in fig. 3. The work that follows will enable the horizontal profile to be gradually attained and in this way the terracing will be completed. At the final working the vines will be duly ridged up so as to give the mound its proper depth (figs. 4 and 5).

This method has the following advantages:

1) The construction of the mound is a simple matter of shovelling the earth already displaced by the plough and close to the mound. In the terracing of a 1:4 slope divided into sections 8 metres wide, a single workman was able to make 50 metres of mound in the day, while one workman by ordinary digging could not have done more than 5 or 6.

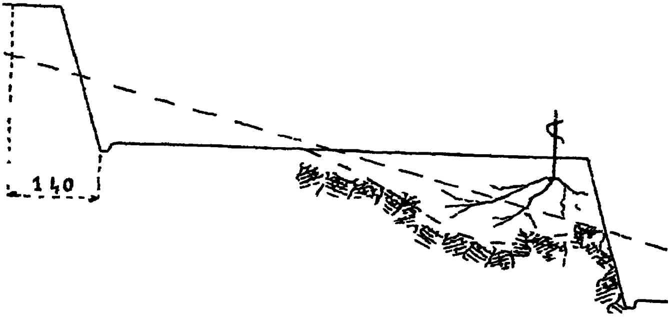

FIG. 5

FIG. 6

2) At the end of the working, the amount of displaced soil available for the planted row is twice as large as that obtained by digging a row in the ordinary way.

3) The amount of soil taken from the herbaceous crops is considerably less than that resulting from a form of terracing which is alternatively too wide for the herbaceous crops and too narrow for the rows of vines.

4) The first construction of several mounds across the slope ensures, beginning with the first year, against erosion or washing away by rain.

5) The grass border affords greater security for animals working close to the edge of the terrace and also for carts passing along the terrace.

6) Standing water is avoided in the built-up soil.

7) The soil which forms the mounds and is used by the roots of the vines all belongs to the cultivated layer.

This method is applicable to all exposures, except a southern. In this case, as in all other forms of terracing, the evaporating surface is unduly large, which is injurious in warm climates. In order that the young vines when first planted in the mounds may enjoy the most favourable conditions, the author recommends for the first two years the growing on the crossing sections such vegetables as admit of cropping towards the end of spring so that ploughing can immediately follow, providing fresh material for the mound and preventing it from becoming too dry.

1091 – **The Supply of Fertilisers and the Increase of Agricultural Production in Germany.** — HILTNER (Direktor der Landesanstalt für Pflanzenbau und Pflanzenschutz). in *Sonderabdruck aus dem* 6. *Sitzungsbericht des Bayer. Landwirtschaftsrates vom* 22 *Dezember* 1920. *IInd. Edition.* Munich, March 1921.

The author describes the present conditions of agricultural production from the point of view of the supply of fertilisers in Germany and particularly in Bavaria.

The fall in the cost of food stuffs, which is so much desired, can take place only when agricultural production shall not merely have reached but gone beyond the pre-war level. On the other hand despite all appeals for increased production there is in fact such a decrease from year to year, especially in cereal and potato crops that, if a remedy cannot be found, the results will be disastrous for the German people.

The causes of this situation which in the years to come will bring about grave difficulties in food supply are to be found in the various obstacles, which at present fetter agricultural production, e. g. shortage of labour, exceptional diminution of manure alike in quantity and quality, lack or insufficient application of fertilisers. These handicaps force the farmers more and more in the direction of extensive cultivation at a time when the food requirements of the German people, which can scarcely be met by the home production call, for a cultivation in its most intensive form.

During the last 6 years, land under cultivation in Germany received 1 500 000 tons of nitrogen and 1 600 000 tons of phosphoric anhydride less than the required amount and at best the deficit can only be made good gradually (1). To meet the extreme general need for nitrogen the whole German Empire had at its disposal for the season 1920-1921, 270 000 tons of nitrogen in the form of fertilisers, whereas the capacity for the production of synthetic nitrogen by the plants set up during the war would amount to 500 000 tons corresponding to the minimum annual requirements of German agriculture.

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(1) According to MULLER LENHARTZ (Der Kreislauf des Stickstoffs pp. 29-32. Hanover, 1917) the average quantity of nitrogen consumed per hectare of land cultivated in the 30 chief crops would amount to 90 kg. annually which, multiplied by the 34 500 000 hectares under cultivation in Germany before the war, gave for the whole German Empire, a consump-

The lack of phosphoric anhydride is also particularly important because the production of basic slag has diminished in consequence of the loss of the iron-working aıeas in the west and the fact that superphosphates have to be prepared almost entirely with phosphate from overseas which are particularly expensive in consequence of the depreciated exchange. Basic slag is now 20 times dearer than before the war and superphosphates 33 times, taking into account the already high cost of pyrites which has to be imported. The total German consumption of phosphoric anhydride in fertilisers, which for the season 1913-1914 was 630 000 tons, was reduced in 1918-1919 to 230 000 tons and has latterly still further decreased. As the consumption of fertilisers had formerly been least in Bavaria, it is impossible in general to reckon on reserves of phosphate accumulated by previous heavy applications (2); in fact an examination of Bavarian soil, made in 1920, showed that more than half the soils which were tested were insufficiently supplied with phosphoric anhydride. In any case, if the Government is unable to co-operate in bringing down the cost of nitrogenous as well as of phosphatic fertilisers, some other mean of effecting a reduction must be devised or at least the payment of two-thirds of the cost must be allowed to stand over till after haıvest.

As regards the consumption of potassic salts however, there has been a marked increase lately in Germany: the increased price is only five or six times higher than before which is satisfactory provided there be no further augmentation. This result can be attained by increasing the

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tion of nitrogen amounting to 30 050 000 quintals, in part constisting of the following items:

	Quintals		Quintals
Seed	862 500		
Atmospheric precipitation	414 000	By-products of gas industry	713 000
Bacteria from leguminous plants	9 500 000	Calcium cyanamide	150 000
Purin	1 275 000	Synthetic ammonia	63 636
Human urine	766 500	Imported nitrate of soda	100 000
Solid excrements	1 000 000		
Industrial waste products	1 000 000	*Total*	**16 744 636**

There is therefore, a deficit of 14 305 364 quintals of nitrogen which cannot be made good, unless there be in the soil other microbiological forces to supply the balance from the atmosphere.

(2) According to AEREBOE (Volksernährung, Stickstoffdünger and Stickstoffpreise, II. Deutsche Landw. Presse, XLVII, 101, pp. 688-689. Dec. 18, 1920) general conditions in Germany as regards phosphatic fertilisers are better than appears at first sight. He bases his argument on the conclusions drawn by GERLACH. According to these, if crops take out from the soil an average of 1 part of nitrogen, $^1/_2$ of phosphoric anhydride and $^1/_2$ of potash, it receives by way of compensation 1 part of nitrogen, 3 of phosphoric anhydride and 2.7 of potash and, as in practice phosphoric anhydride is not washed away by rain, a good reserve should have accumulated. (*Ed.*)

export which will of necessity increase production, due regard being paid at the same time to the loss of the Alsatian deposits. The first condition necessary for obtaining good results from potassic and nitrogenous fertilisers is an adequate reserve of lime in the soil. In Bavaria many tracts of cultivated or meadow land, as has been frequently demonstrated during the last few years, are poor in lime, a defect that should immediately be remedied by limeing and marling on an extensive scale. At the same time one must not lose light of the fact that a reduction in the price of nitrogenous and phosphatic fertilisers is not the only thing necessary, especially in countries where, as in Bavaria, small holdings predominate; the chief essential is an organisation ready to give technical assistance to every farmer.

1092 - **Italian Phosphate Mines in Egypt.** — CORTESE, E., in *La Minera italiana*, Year V, No. 1, pp. 14-24, figs. 14. Rome, Jan. 31, 1921.

Description of two phosphatic seams in Sebaieh, alongside the Nile, in Upper Egypt and in Kosseir near the Red Sea.

The content of tricalcic phosphate in the first mentioned is about 60 %; taken as a whole, however, the average may be limited to 58 and even to 45 %; occasionally it has been found to be as high as 70 or 73 %

All these phosphates contain however more than 2 % of sesquioxides of iron and aluminium, in some cases to the extent of 4 to 6 %. For sale purposes, 4 % has been taken as the mean, and it has been decided that a depreciation of 2 units of phosphate to 1 of sesqui-oxide should be applied only from 3 %.

At these places, a factory for the manufacture of tetraphosphate has been constructed in order to utilise the siliceous phosphates containing not more than 45-48 % of tricalcic phosphate, more than 1 million tons in the Nile districts. If the outlying districts are also considered, it is possible to count upon 2 million tons.

Other seams, showing very superior quality phosphate, have been noted in the *ouadi* (valleys) on the right bank of the Nile, and in the hills on the left bank of the Nile. Taking into account the difficulties of transport to the sea coast and the comparatively low phosphatic content, these seams have up till now not been exploied.

Along the Nile bank and at Djebel Agula, Djebel Hagarza and Djebel Gorn, there are very well marked seams, showing several phosphatic beds but in every case siliceous. Even along the caravan routes crossing the Arabian desert, inferior quality phosphates have been noted. Beyond the division of the river basin, in the direction of the Red Sea, the phosphatic zone reappears at Djebel Duai, where there is visible a large bank of grey phosphate at a distance of 30 km. from the sea coast. Then comes the seam at Djebel Narkeil, 12 km. from Kosseir, where the standard of phosphate varies to a large extent, but with regularity. It is stated that below this, there is a large layer of yellow phosphate varying round 53 % and other phosphates of the same type (6 in all), not exceeding 48 %, owing to the presence of silicate or other impurities. There is at least 1 million tons of this last type.

Following this come the grey siliceous phosphates in two beds, also to a limited extent, but the principal layer maintains a comparatively high content (64 to 69 %) with only very little silica, and only a 1 % average of sesqui-oxfdes of iron and aluminium; these may be considered therefore as very superior quality phosphates. As regards the white and grey phosphates, where these occur to a reasonable thickness, it is possible to count on 2 million tons, and even now the work executed has dealt with about 500 000 tons of phosphatic bed. The high quality and percentage of phospate compensates for the cost of transport from Kosseir to the Italian ports including the big tax levied at the Suez Canal.

1093 - **The Effects of Liming on the Availability of Soil Potassium, Phosphorus and Sulphur.** — PLUMMER, J. K. (North Carolina Agricultural Experiment Station, West Raleigh, N. C.), in *Journal of the American Society of Agronomy*, Vol. 13, No. 4, pp. 162-171, bibliography of 21 publications. Lancaster, Pa., Apr. 1921.

A discussion dealing with the important question of the effects of liming on the availability of soil potassium, phosphate, and sulphur.

The more recent research, embodying laboratory extractions with weak solvents, pot studies using a variety of plants as indicators of the concentration of the soil solution in potassium and the analyses of their ash, lysimeter experiments by which the production of potassium has been measured, and field tests, has failed to show that basic compounds of calcium and magnesium increase, by chemical action, to any practical extent, the availability of the soil store of native potassium.

More research needs to be carried out before we can say that additions of lime will reduce the necessity of applying soluble phosphates to the soil. As measured by yields, phosphates of iron and aluminum seem to be as available as calcium phosphates. It is very probably true that fixation of phosphatic fertilizers by colloidal absorption induced by iron and aluminium oxides is responsible for the failure of some crops to respond to phosphorus additions. Additions of lime to such soils undoubtedly flocculate some of these colloids, thus giving the soils a better physical condition for plant growth. Additions of lime before or after applications of soluble phosphates. have greatly increased the efficiency of the phosphatic fertilizer. When insoluble calcium phosphate has been applied, it seems that applications of lime have reduced the effectiveness of the phosphate in the majority of cases.

The scant data of lysimeter experiments only, which deal with the question of sulfate availability or conservation, seem to show that liming with small amounts of lime, both small and large amounts of magnesia, magnesium carbonate, limestone, dolomite, and magnesite, increases the solubility of native soil sulfate. Heavy applications of lime for a few years at least, apparently reduce this loss of sulphur from the soil.

1094 — **Leucite.** — GIANNOBI J., *La Leucite, Memoria premiata col Premio Cesare Zucchini della R. Università di Bologna*, pp. 56, bibliography of 74 works. Osimo, 1921.

Monograph upon: The Italian deposits of Leucite. (*La leucite in natura*); industrial utilisation of leucite (*La leucite nell'industria*); its utilisation by plants (*La leucite come fonte di potassa agricola*); its application to agriculture. (*La leucite nella sperimentazione agraria*).

In this last section, after quoting the results of the somewhat scanty previous researches (AMPOLA and DE GRAZIA, BERNARDINI, CARUSO, MONACO, GIGLIOLI, BANDINI, NAZARI, CECCHETTI, ANGELONI, BONOMI, FELCINI), the author describes his own investigations made on three plots in the years 1909, 1910 and 1911.

The following was the scheme of treatment per plot of 100 square metres:—

1) Control
2) Sulphate of ammonia, mineral superphosphate, potassium chloride
3) Nitrate of soda, mineral superphosphate, sulphate of potassium
4) Mineral superphosphate, leucite
5) Potassium sulphate
6) Sulphate of ammonia, nitrate of soda
7) Sulphate of ammonia, mineral superphosphate, leucite
8) Nitrate of soda, mineral superphosphate, leucite
9) Potassium chloride
10) Leucite.

Amounts per hectare: sulphate of ammonia Nos. 2 and 7, 200 kg.; No. 6, 100 kg.; nitrate of soda, Nos 3 and 8, 150 kg. No. 6,100 kg.: mineral superphosphate, 500 kg.; potassium chloride; No. 10, double application. The rotations were as follows: — On the first plot (sandy soil) Noé wheat, meadow clover and sainfoin combined (investigation abandoned); on the second plot (calcareous clay soil) Noé wheat, sulla and meadow clover combined, reproduced Rieti wheat; on the third plot (clay loam) Noé wheat, horsebeans, reproduced Rieti wheat.

The returns obtained, in grain for the wheat, in dry fodder for the grasses and in seeds for the beans justify the following conclusions:

1) Leucite is a powerful potash fertiliser comparable in its effects to Stassfurt salts (manure salts).

2) Its beneficial action is most pronounced in soil that is rich in lime, less in sandy soil and still less in clay soils.

3) Its effects begin to be shown after the first year and tend to increase with subsequent years.

4) In complete mixtures a combination of leucite with ammonium sulphate is preferable to one with ammonium nitrate.

In fact leucite either alone, or associated with other fertilisers has always held its own with other potash salts and has occasionally given better results. The varying action of leucite on the different soils that have been tested depends upon their physical, chemical and biological variations which are very difficult to analyse. The effect of leucite as a fertiliser tends to increase after the first year, and if it is found that the results in the second year are less satisfactory than in the first, there are cases in which the best results are given in the third year. It is possible therefore to ascribe the unfavourable results in the second year not so much to any weakening in its action as to the change of crop (leguminosae), for which Stassfurt salts would have been better than leucitic potash. The fact that leucite has a preference for sulphate of ammonia supports the theory of the comparative inefficacy of basic substances in lieu of leucitic potash, since it is more effective in conjunction with a salt that is physiologically acid such as ammonium sulphate than with a salt that is physiologically basic such as sodium nitrate which in the absence of leucite is not found in a complete mixture.

1095 - **Radioactivity Experiments in Spain.** — *Estación central de Ensayos de Semillas, La Moncloa, Madrid, Boletín trimestrial*, Year I, No. 2, pp. 7-8. Madrid, June 1921.

Experiments carried out by Prof. MUÑOZ DEL CASTILLO, of the University of Madrid, at the " Instituto agrícola de Alfonso XII " on 8 plots 4 sq. metres in area with maize; the height of the stalks, weight of the ears, and weight of 1000 kernels being the subjects of comparison. Radioactivity was produced by watering with water containing the chloride of the radioactive substance. The results are given in Table I.

TABLE I. — *Effect of Radioactivity on the Growth of Maize.*

Plot N°	Treatment	Average height of stem in metres	Number of plants per plot
1	Complete fertiliser	2.18	24
2	Complete fertiliser + rhodium	2.20	23
3	Complete fertiliser + thorium (50 gm. per hectare) .	2.16	23
4	Complete fertiliser + thorium (50 gm. per hectare) + rhodium	2.11	22
5	Complete fertiliser + thorium (48 gm. per hectare) + rhodium	2.28	24
6	Complete fertiliser + thorium (30 gm. per hectare) + thorium	2.40	22
7	Complete fertiliser + thorium (20 gm. per hectare) + rhodium	2.35	25
8	Complete fertiliser + thorium (18 gm. per hectare) + thorium	2.22	22

RESULTS OF THE EXPERIMENT. — 1) Plot No. 6, with 30 gm. of thorium per hectare, and plots 7 and 5 with 20 and 40 gm. of thorium, respectively per hectare showed the maximum effect of radioactivity as regards growth in height.

2) Plots 4 and 3 showed that quantities above 30 gm. of thorium per hectare have a toxic effect.

3) In plot No. 8 (10 gm. of thorium per hectare), the effect was negligible and the dose insufficient.

4) Comparison of plots 2 and 8 shows that if thorium is added to rhodium, even in small quantities, the effect of the latter is increased.

5) The result obtained from plot 1 can only be attributed to the

influence of the 1210.6 volts of gaseous radioactivity observed in this plot, the same influence made itself felt also in plot No. 5; on the other hand, no such effects were noticed in plots 4 and 8, where the radioactivity only amounted to 636 volts.

Table II gives the effect of radioactivity upon the ears; this being to some extent masked by that of hybridisation.

TABLE II. — *Effect of Radioactivity Upon Maize Production.*

Plot No	Weight of 6 white ears in gm.	Weight of 6 red ears in gm.	Weight of 100 white kernels in gm.	Weight of 100 red kernels in gm.
1	937	927	298	283
4	1866	1273	315	400
5	966	911	287	281
6	1107	1389	275	469
7	994	930	283	367
8	961	1110	236	256

1096 - **The Condition of Chlorophyll in Plants.** — LUBIMENKO, V., in the *Comptes rendus de l'Academie des Sciences*, Vol. 173, No. 6, pp. 365-367. Paris, August 8, 1921.

From the experiments described in this paper, the author draws the conclusion that chlorophyll is intimately connected with the protein substances of the plant and that this connection is probably of a chemical nature. It is also most likely that the chloroplasts of normal green colour only contain a single green pigment that is easily decomposed through the action of all those agents that coagulate protein substances by merely producing some alteration in them. This decomposition of the natural pigment is shown by a greater or less change in its optical qualities and its absorption spectrum. Chlorophyll *a* and *b*, as well as a series of variable yellow pigments, are probably only derivatives of a single original green substance which, judging from the absorption spectra, would seem not to be the same in all green plants. The author's researches on the absorption spectrum of living leaves have shown that the spectrum varies greatly in the leaves of different species of plants, and in all likelihood, these optical variations are due to chemical variations in the protein substances with which the green pigment is connected.

1097 - **The General Presence of Manganese in Plant Tissues.** — BERTRAND, G., and ROSENBLATT, M., in the *Comptes rendus de l'Academie des Sciences*, Vol. 173, No. 5, pp. 333-336. Paris, August 1, 1921.

According to MAUMENÉ (*Bull. Soc. Chim.* Series 4, Vol. 9, p. 361, 1911), there are some plants in which no manganese is found. Some of these plants are of quite ordinary chemical composition such as orange and lemon trees, whereas others like garlic and onion, etc., contain sulphohydric, or sulphocyanhydric compounds. Bran, the receptacle of the strawberry, and the leaf-tissue of the cabbage are also free from manganese according to MAUMENÉ.

In view of the importance of these exceptions (if they actually exist) from the standpoint of the biochemical action of manganese and further, that MAUMENÉ determined the presence of this element merely by observing the green colouration of ash heated to melting point (so that probably he had failed to detect its presence in ash that was not sufficiently alkaline, or was fused with difficulty), the authors made a further study of the question, and found manganese in all the plants analysed, amongst which were those mentioned by MAUMENÉ as not containing it.

" It may therefore be affirmed as a result of all the work hitherto published on the subject that manganese is of general occurrence in plants, being present, not only in all the various species, but also in all their organs. "

1098 – **The Nature and Extraction of a Substance that Generates Hydrogen Sulphide in the Seeds of Certain Papilionaceae** (1). — MIRANDE, M., in the *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 4, pp. 252-255. Paris, July 25, 1921

The substance occurring in the seeds of certain *Papilionaceae*, and especially in those of vetches (*Lathyrus sativus* and *L. Cicera*), which when it comes in contact with water, spontaneously liberates hydrogen sulphide, appears to be a special protein that gives off its free sulphur in the form of the above.

The author has isolated this substance by grinding ; extraction with ether and then with alcohol at 96° C ; soaking the extracted material in distilled water ; filtering on glass-wool : allowing it to take up a little water ; pressing ; mixing the two liquids ; precipitation with neutral lead acetate ; filtration ; precipitation of the excess lead in the filtrate by a current of sulphuretted hydrogen ; filtration ; precipitation with concentrated ammonium sulphate, or with alcohol or by heating to 55° C.

The white, amorphous substance thus obtained liberates sulphuretted hydrogen at 35°-40° C, and gives all the chief reactions characteristic of proteins.

1099 – **The Relation of Certain Nutritive Elements to the Composition of the Oat Plant with Special Reference to the Calcium and Phosphorus Content.** — DICKSON, J. G., in *American Journal of Botany*, Vol. VIII, No. 5, pp. 256-271, figs. 2, tables 10, bibliogr. of 41 works. Lancaster, Pa., May 1921.

From 1871 onwards a quantity of literature has been devoted to the study of the relation of various environmental factors to the composition of plants, but the work has never been satisfactorily concluded. The author started experiments with a view to studying the effect of limiting certain essential nutrient elements upon the composition of the grain and straw of well matured plants when other environmental factors were as far as possible controlled.

The culture work from May to August in 1915 and 1916 respectively was carried on under climatic conditions different from those that prevailed during the latter part of the work, which may in some cases explain the differences between the data recorded for the two respective periods. A brief comparison of the meteorological data for the 2 periods has been included in the present paper. From September 1916 until 1917 the work was continued in the laboratory of plant physiology at the University of Wisconsin.

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(1) See *R.* June 1921, No. 641 ; *R.* July 1921, No. 706. (*Ed.*)

The normal solution employed consisted in KNOPS solution modified by the addition of 0.1 gm. of sodium chloride per litre of solution, and diluted to $^1/_{10}$ the concentration usually employed; and of 5 further modified culture solutions in each of which one of the elements, magnesium, calcium, potassium, phosphorus, and nitrogen was reduced to $^1/_{10}$ of the quantity present in the normal solution.

Pedigree Swedish select oats, *Avena sativa aristata* were used in all the experiments. In most cases the quantity of the plant material produced was too small to permit the analysis of the grain and straw for all the essential nutrient elements and determinations were therefore confined to total phosphorus and calcium content.

It was found that the calcium content of both grain and straw was reduced to about 10 % of that of the plants from the controls, by reducing the calcium in the culture solution according to the above mentioned method. The average calcium content of the straw from the calcium deficient solutions was only 13 % of that produced in normal cultures. It was greatly reduced in both grain and straw by a similar deficiency in phosphorus or in nitrogen.

As regards the relation between nutrients and content of the oat grain, the total phosphorus content of the grain was reduced to 46 % and of the straw to 10 % of that in the plants from the controls by reducing the phosphate on the $^1/_{10}$ system in the culture solution. It was slightly reduced in both grain and straw by a similar deficiency in potassium, and increased by a similar reduction of calcium or nitrogen.

The following table shows the average composition of plants grown in the normal solution and in solution with one nutrient element in each case reduced to $^1/_{10}$ the normal amount.

Solution Deficient element given	Percent. Calcium Oxide (CaO)		Percent. Phosphoric Pentoxide P_2O_5	
	Grain	Straw	Grain	Straw
Normal	0.697	3.114	1.206	0.628
Calcium 0.1	0.097	0.408	1.364	0.667
Magnesium 0.1.	0.729	2.589	1.092	0.673
Potassium 0.1	0.734	2.763	1.084	0.427
Phosphorus 0.1.	0.366	1.727	0.552	0.068
Nitrogen 0.1	0.451	1.519	1.336	1.463

The relation of climate to the composition of the oat plant, showed that variations in composition were more pronounced in the straw, but were more or less analogous in both grain and straw. The combination of temperature, humidity and other climatic conditions greatly influenced the composition of the plants except when the reduction of certain essential nutritive elements became the predominant factor in controlling plant development. Under these conditions variations due to the environmental factors were outweighed by the deficient nutritive element.

With a few exceptions the phosphorus content was highest in the 1917 samples and lowest in the 1915 samples. The average of all the grain analysed each year from 1915-1917 was 0.679 % in 1915, 0.976 % in 1916 and 1.570 % in 1917. The increases in phosphorus content of the straw were equally high. This fact stands out conspicuously when compared with the contents of both grain and straw of plants grown in phosphorus deficient solutions which showed no influence of climate on composition.

The calcium content of grain including the calcium deficient solutions, was highest in 1917 and lowest in 1915. The calcium content of the straw did not appear however to be greatly influenced by seasonal differences.

No attempt is made to correlate the variation in composition with any given factor, as it is only a case of speculation until controlled experiments have determined the relation of such factors as light intensity, air and soil temperature and humidity on the development and composition of plants.

1100 - **The Effects of Senility in Plants.** — MONTEMARTINI, F. (Istituto botanico della R. Università di Pavia), Extract from the *Atti del R. Istituto botanico dell'Università di Pavia*, pp. 133-135, 1921

According to M. B. HARRIS (1) the effect of senility in plants is to give rise to a denser growth of the vein system with a reduction of the portions bounded by the veins.

The author has made a new contribution to our knowledge of the phenomenon of senility by determining the proportion of ash, on a dry-weight basis, in the leaves of old and of young individuals of the same species of tree. He obtained the following percentages:— Leaves of *Platanus occidentalis*: over 120 years old, 11.20 ; 15 years old, 10.32. Leaves of *Aescolus Hippocastrum*: 40 years old, 8.78 ; 4 years old, 7.43. Leaves of *Aesculus Hippocastrum:* over 100 years old, 9.64 ; 3 years old, 8.41. Last leaves, of *Abies pectinata:* about 100 years old, 4.62 ; 15 years old, 3.16.

It will thus be seen that the leaves of old trees have a greater ash content on a dry basis, than the leaves of young trees. A series of quantitative analyses, which have already been begun, will show whether this difference is connected with the fact that in the leaves of old trees, the vein system is denser, and the veins themselves contain more ash than the mesophyll, or whether it depends upon special senile changes taking place actually in the cells of the mesophyll.

(1) See *R.* Feb. 1921, No. 208. (*Ed.*)

1101 - **The Intensity of the Green Colour As a New Factor to be Taken into Account in Wheat Selection.** — WESTERMEIER, KURT, in the *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, Part I, pp. 14-25. Berlin, March 1921.

Chlorophyll is a fundamental factor in all the physiological processes leading to increase of substance, and since the chief aim of all breeding work connected with agriculture is to increase the yield, the study of chlorophyll from the genetic standpoint is of paramount importance.

The author's experiments were carried out on the following varieties and kinds of wheat :—

WINTER WHEAT. — *Triticum vulgare* : — Nassauer Milchweizen, Klädener Altmärkischer Braunweizen, Crievener 104, Siebenbürger gefleckt, Strubes Squarehead.

Triticum turgidum : Wohltmanns Schwarzer Bartweizen, Wohltmanns Weisser Bartweizen, Kirsches fruher Grannenweizen.

Triticum capitatum : Cimbals Geheimrat Wohltmann.

SPRING WHEATS. — *Triticum monococcum vulgare, T. dicoccum seringeanum album, T. Spelta Arduini, Triticum polonicum, T. durum* (Durum wheat and Portuguese Lobeiro), *T. vulgare* (Bielokoloska, Svalöfs Perl ; Rapado de espica blanca, Rimpaus Roter Schlanstedter, etc.), *Triticum compactum* (Mocho de espica quadrata, Igel and Binked), *T. turgidum* (Ontario, Utah, Branco).

The author studies the connection between the different metabolic processes and the development of chlorophyll as shown by a scale of colours based on two fundamental colour schemes : 96 green mottled with yellow, and 92 (decided green).

The following results have been obtained :—

A. *Effect on the Plant of Chlorophyll Development.*

I. — The plants of the *vulgare* form, colour 96 ;

(*a*) In the first stages, grow more slowly the deeper the colour.

(*b*) The reverse occurs at the time of heading, the darker plants developing more rapidly.

(*c*) The dark types head earlier than the light.

(*d*) The total growth period of the dark types is longer than that of the light.

II. — The plants of the *vulgare* form colour 92, have, as has been said, a shorter growth period, they develop slowly until the heading stage, but from that time, the process is accelerated (until the stage when growth ceases), as if the chromatic type 92 was able to turn the solar energy to better account.

III. — The same occurs both with the *compactum* and *vulgare* forms.

IV. — The dark *turgidum* forms first grow quicker than the light forms, and it is only at the flowering season that they are out-distanced by the latter, which have altogether a longer growth period (thus differing from *vulgare*).

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(1) See *R.* Sept. 1916, No. 96[illegible]. (*Ed.*)

V. — The light types flower later.

VI. — The darker the colour, the less is the foliage in proportion to the length of the culm. There is thus, economy of leaf-surface.

VII. — The development and tone of the leaves influence the culm length, which increases with the intensity of the colour. The same applies to the thickness of the culms.

B. *Effect of Chlorophyll on the Grain*: I. — The weight of kernels per ear, the content of nitrogenous substances, of dry matter and ash increase as the green of the vegetative parts becomes deeper.

II. — With greater intensity of colour, the proportion of nitrogenous substances to dry matter increases with growing rapidity, though the dry matter content itself tends to rise.

III. — The proportion of nitrogen free substances to gluten decreases with the intensity of the colour.

IV. — The same colour shade may have different effects upon different varieties of wheat.

1102 - **Concerning the Inheritance of Green and Yellow Pigments in Maize Seedlings and the Interesting Phenomena of "Linkage" and "Crossing Over."** — LINDSTROM, E. W, in *Genetics*, Vol. 6, No 1, pp 91-110. Baltimore, M. D, Jan. 1921.

INTRODUCTION. — There are 3 quite distinct types of abnormal maize seedlings: the albino or pure white, the virescent or greenish-white and the yellow. These 3 types are inherited as simple Mendelian recessives to normal and dominant green, and are governed by the 3 following factors:

1) **W**: when homozygous, this entirely prevents the development of chlorophyll, the result being a pure white plant.

2) **V**: when homozygous, this may repress partially or delay the formation of green pigment; the result being greenish-white. Directly after germination, the seedlings are white, but under optimum conditions of light and temperature sufficient chlorophyll may develop to mature and set the seed.

When a green plant, heterozygous for both factor-pairs (**Vv Ww**) is self-pollinated, 9 : 3 : 4 ratio is obtained as follows:

9 **V W** green
3 **v W** greenish white
3 **V w** white
1 **v w** white

Sufficient data are available to establish the conclusion that these factors are inherited independently.

3) **L**: the determinant for yellow. When a green plant heterozygous for both greenish-white and yellow seedlings is self-pollinated, a 12 : 3 : 1 ratio results as follows:

9 **L V** green
3 **l V** green
3 **L v** greenish white
1 **l v** yellow slightly virescent)

TRIHYBRID RELATIONS. — From the cross L l Vv WW × L L V V W w, where 3 factor pairs are concerned in the development of green chlorophyll and yellow pigment, the F_1 plants were completely green both in the seedling and fully-developed stages. In F_1, 8 different genotypes should be produced, according to the gametical constitution, but only 5 of the 8 appeared.

1-2) Two kinds of green.

3) One type segregating into 3 greens to 1 white

4) One type segregating into green, greenish white and white in the ratio 9 : 3 : 4.

5) One new type segregating into green, greenish white, yellow and white, giving a peculiar ratio of these characters, 36 . 9 : 7 : 12, which is explained as follows :

27	**L V W**	green seedlings	3	**L v w**	white seedlings
9	**l V W**	» ›	3	**l V w**	yellow ›
9	**L v W**	greenish white seedlings	3	**l v W**	›
3	**L V w**	white seedlings	1	**l v w**	› ›

Among the F_1 genotypes of the original cross, the gametic composition should be LlVvWw. An analysis of F_2 confirms the trihybrid relations and presents material relative to the discovery of the independence of the 3 factors L, W and W, which it may be assumed are located on separate chromosomes

RELATION OF LINKAGE BETWEEN COLOUR FACTORS OF SEEDLINGS AND THE COLOUR OF THE R ALEURONE FACTOR. — With the material employed during these experiments, the segregation of characters does not only concern the aleurone, but also the colour of the pericarps, and it is difficult to determine with exactitude the chromatic constitu-

Seedling progeny from ears with colourless pericarp.

Pedigree Number	From coloured aleurone			From colourless aleurone		
	Green	Greenish white	Yellow	Green	Greenish white	Yellow
2343–10	156	50	1	59	1	22
2343–19 . .	157	53	0	60	1	19
2343–24	186	52	1	60	1	18
2343–25 .	67	23	0	22	1	10
2343–30 . .	229	75	0	72	0	27
2343–31	179	50	0	66	1	25
Total .	**974**	**303**	**2**	**339**	**5**	**121**
Total theoretical (independent inheritance)	959	240	80	349	87	29

tion of the former. Certain ears, however, with colourless pericarps have been found, which permitted an accurate separation into coloured and colourless aleurone (See Table).

If the factors R and L were independently inherited, we should expect a 12 : 3 : 1 ratio of green, greenish white and yellow seedlings from both coloured and colourless seed. But according to the Table the results are contrary to expectation : from the coloured aleurone instead of 80 yellow seedlings, only 2 actually occurred, and from the colourless aleurone, instead of 87 greenish-whites, only 5 appeared. Evidently therefore the gametes **R l** and **r l** are produced far in excess of the cross over gametes **r l** and **R l**, and the latter formation is practically never produced.

According to the data given, the percentage of crossing over is estimated at 1.6.

1103 - **Sterile Male Anthers of Maize as Heritable Characteristics.** — EYSTER, L. A., in *The Journal of Heredity*, Vol. XII, No. 3, pp. 138-141, figs. 3. Washington, D. C., March, 1921

Male sterile plants are distinguishable from the normal by the fact that no pollen forms in the anther sacs and they remain undeveloped. The sterile spikelets are almost empty and usually remain flattened against the rachis, giving a characteristic appearance to the whole rachis.

This appearance is regulated by the genetic factor **m. s.** In progenies grown from self-pollinated heterozygous plants **Ms ms** the number of *normal* and male *sterile* plants appeared to be in the ratio of 3 : 1.

Pedigree	Normal	Male sterile
A 133—12	48	17
S 11— 1	33	11
Total . . .	81	28
Estimated total (3 : 1) . .	82	27

From the crosses **ms ms** × **Ms ms**, the ratio between the number of normal and male sterile plants appeared to be 1 :1.

Pedigree	Normal	Male sterile
Er 276	50	53
Er 277-280.	104	110
Er 283	92	91
Total . .	246	254
Estimated total (1 : 1) . . .	250	250

1104 - **Studies in the Heredity of the Colour of Rice Glumes.** — YAMAGUCHI, Y., in *The Botanical Magazine*, Vol. XXXV, No. 414, pp. 106-112. Tokio, June 1921.

The rice variety " Karasumoti " has violet-black glumes and variety " Sinriki ", whitish-yellow. By crossing these two varieties, in F_1, individuals with violet black glumes have been obtained, but of a somewhat paler tint than that of the parent Karasumoti.

In F_2, the segregation phenomena are evidently very complicated, producing 5 distinct types :—

I) N = violet black.

II) B = glumes tinged with violet-black only at the two extremities of each glume.

III) C = reddish-brown.

IV) D = reddish-brown at the tips only.

V) E = whitish-yellow.

The examination of other shoots up to F_3 and F_4 brought to the forefront the following facts : —

I) 7 different types may be picked out in the A progeny.
1) Constant, i. e. breeding true from A.
2) Segregated — 328 A : 109 E, approximate ratio 3 : 1.
3) Segregated — 36 A : 10 B : 18 E. approximate ratio 9 : 3 : 4.
4) Segregated — 249 A : 89 C ; approximate ratio 3 : 1.
5) Segregated — 27 A : 12 B : 7 C : 3 D ; approximate ratio 9 : 3 : 3 : 1.
6) Segregated — 162 A : 47 C : 88 E : approximate ratio 9 : 3 : 4.
7) This type corresponds to F_1, and has the same gametic composition, i. e. heterozygote relatively to 3 factors and segregating into 5 forms : 23 A : 7 B : 12 C : 4 D : 19 E ; approximate ratio 27 : 9 : 9 : 3 : 16.

II) 4 types may be distinguished in B progeny.
1) Constant, reproduction of B.
2) Segregated — 339 B : 124 E ; approximate ratio 3 : 1.
3) Segregated — 307 B : 94 D, ratio 3 : 1.
4) Segregated — 156 B : 45 D : 59 E, ratio 9 : 3 : 4.

III) 4 types may be distinguished in C progeny :
1) Constant, reproduction of C.
2) Segregated 88 C: 27 D, ratio 3 : 1.
3) Segregated 173 C : 79 E, ratio 3 : 1.
4) Segregated 126 C : 47 D : 48 E, ratio 9 : 3 : 4.

IV) 2 types in D progeny.
1) Constant, reproduction of D.
2) Segregated, 265 D : 102 E, ratio 3 : 1.

V) The E progeny, although they show different genetic combinations, are all constant as regards colour.

From these facts it may be concluded that the colour is formed in a tri-hybrid mendelian manner. B may be taken as the violet determinant, R as the red determinant and S the factor which limits the red to the two extremities of the glume. If it is supposed that B and R are not able to manifest themselves in the absence of S, the following formulae may be indicated: for Karasumoti, **BB RR SS**, for Sinriki, **bb rr ss**: for F_1, hybrid **Bb Rr SS**; and for F_2, the 5 types **A, B, C, D, E,** quite distinctive and in the ratio 27 : 9 : 9 : 3 : 16 that is to say:—

Type A: **BBRRSS** (1) **BBRrSS** (2) **BBRRSs** (2) **BBRrSs** (4)
BbRRSS (2) **BbRrSS** (4) **BbRRSs** (4) **BbRrSs** (8)
Type B **BBrrSS** (1) **BbrrSS** (2) **BBrrSs** (2) **BbrrSs** (4)
Type C· **bbRRSS** (1) **bbRrSS** (2) **bbRRSs** (2) **bbRrSs** (1)
Type D **bbrrSS** (1) **bbrrSs** (2)
Type E **BBRRss** (1) **BBRrss** (2) **BBrrss** (1)
BbRRss (2) **BbRrss** (4) **Bbrrss** 2)
bbRRss (1 **bbRrss** (2) **bbrrss** (1)

According to this hypothesis, it appears evident that each of the members included in each type should show its genetic constitution according to the method of segregation in *F*, except the elements in group E, not coloured, which should remain constant.

Individuals	Method of segregation	Individuals	Method of segregation
	Type A		*Type C*
BBRRSS	Constant	**bbRRSS**	Constant
BBRr SS	3 A : 1 B	**bbRrSS**	3 C : 1 D
BBRRSs	3 A : 1 E	**bbRRSs**	3 C : 1 E
BBRr Ss	9 A : 3 B : 4 E	**bbRrSs**	9 C : 3 D : 4 E
Bb RRSS	3 A : 1 C		
Bb Rr SS	9 A : 3 B : 3 C : 1 D		*Type D*
Bb RRSs	9 A : 3 C : 4 E		
Bb Rr Ss	27 A : 9 B : 9 C : 3 D : 16 E	**bb rr SS**	Constant
		bb rr Ss	3 D : 1 E
	Type E		
BB rr SS	Constant		*Type E*
Bb rr SS	3 B : 1 D		All constant
BB rr Ss	3 B : 1 E		
Bb rr Sr	9 B : 3 D : 4 E		

This theory clearly explains the above mentioned facts: the absence in type A of a sub-type to which the formule **BB Rr SS** should correspond, existed in comparatively limited numbers in the individuals examined. An interesting fact has been brought out during these experiments: it is due to the probable existence of "repulsion" between the colour factors and those of the character of the endosperm. Out of 59 individuals with violet-black glumes none possessed an *amylaceous* endosperm whilst 31 (i. e. 53 %) had a *dextrinose* type of endosperm. On the other hand, out of 107 individuals with whitish-yellow glumes, 4 only were *dextrinose*, whilst 65 (i. e. about 60 %), possessed an *amylaceous* endosperm. Similarly, out of 61 individuals with reddishbrown glumes, 2 only (3 %) showed an *amylaceous* endosperm.

[1104]

Repulsion is therefore almost complete as regards colour and *amylaceous* content of the endosperm, and partial as regards a non-coloured glume and a *dextrinose* content. It is certainly very interesting to trace this relation between the formation of a violet-black pigment and a *dextrinose* endosperm. The pigment evidently belongs to a group of anthocyanines which are merely glucosides. The chromogene from which the anthocyanine originates is probably a product resulting from sugar synthesis, whilst amylo-dextrine and erythro-dextrine as found in the rice endosperm, are products only of the decomposition of the amide in the living cells, in other words a changeable substance which is formed at the expense of the sugar during the synthetic formation of the amide.

The author intends to continue his investigations with reference to genetics and physiology.

1105 - **Utility of Further Selection with a View to the Improvement of the Cotton Variety "Pima" in the United States.** — KEARNEY, T H., in *Journal of Agricultural Research*, Vol. XXI, No 4, pp. 227-242, tables 10, fig. 1, pl. 7. Washington, D. C., May 1921.

The Pima variety of cotton which originated with a single plant selection in 1910 covered an area in 1920, in California and Arizona, of 250 000 acres. So great is the apparent uniformity of this variety of cotton that the utility of further selection has been considered doubtful.

The author, however, reports the results of a series of investigations which show that the variety possesses frequently, heritable variations which not only justify, but render even necessary the continuance of selection and line breeding, etc.

Some of the seed collected from the parent plant in 1910 had been successfully preserved, and it was therefore possible to compare the present commercial stock and the line bred strain (32 plants in 1919).

In order to measure the degree of change which might have occurred after several years of selection, the progeny of the parent plant was compared with an equal number of plants, taken at random in the commercial stock, of strain 5-3 and of 2 progenies ($Y_1 A$ and $Y_2 A$) derived from the same strain, but self-fertilised for 5 successive generations.

Three populations therefore exist : *a* = parent progeny, *b* = 5-3 bulk and *c* = 5-3 selfed.

Twelve characters were examined : —

1) *leaf length* (cm.), measured from base of midrib to tip of central lobe ;
2) *leaf width* (cm.), measured from tip to tip of the principal lateral lobes ;
3) *leaf index*, width as % of length ;
4) *leaf vein angle* ; in degrees ;
5) *leaf lobe index* ; leaf length as % of distance from the base of the midrib to the bottom of the upper right hand sinus. The index is still higher for a deeply-lobed leaf;

6) *leaf extension index*; length of basal extension of the blade, below a line bisecting the base of the midrib at a right-angle to the latter as a % of the leaf length;
7) *boll length* (mm.);
8) *boll diameter* (mm.),
9) *boll index* = maximum diameter as % of length;
10) *fibre length* (mm);
11) *lint index* (gm.) = weight per 100 seeds;
12) *seed fuzziness*.

The fibre length, lint index and seed fuzziness are of chief practical importance. Table I shows the means and coefficients of variations; Table II shows the frequency distributions.

Comparison between the commercial stock and the Pima variety proves that there has been a significant improvement in the length and abundance of fibre.

TABLE I — *Means and coefficients of variations for 3 important characters.*

Character	Means			Coefficients of variation		
	Parent	Bulk	Selfed	Parent	Bulk	Selfed
Fibre length (mm)	40.8±0.19	44.6±0.12	42.9±0.12	3.8±0.32	2.2±0.19	2.4±0.20
Lint index (gm)	4.1±0.06	5.6±0.05	4 5±0.06	13.2±1.11	7.9±0.67	11 1±0 94
Seed fuzziness .	3.8±0.17	4 1±0.06	4.7±0.11	1.4±0.12	0.5±0.04	0.9±0 08

TABLE II — *Frequency distributions for characters, fibre length, lint index and seed fuzziness*

Fibre length

	37 mm.	38 mm.	39 mm	40 mm.	41 mm	42 mm	43 mm.	44 mm	45 mm.	46 mm.	47 mm.
Parent progeny . . .	1	3	2	6	11	5	1	2	1	—	—
5–3 line. .	—	—	—	—	—	—	5	9	13	4	1
5–3 selfed. . . .	—	—	—	2	2	4	15	6	3	—	—

Lint index

	3 3 gm.	3.8 gm	4 3 gm	4.8 gm.	5.3 gm	5 8 gm	6.3 gm.	5.8 gm	7 3 gm.
Parent progeny . . .	4	10	13	2	3	—	—	—	—
5–3 line. .	—	—	—	1	18	10	2	—	1
5–3 selfed	—	4	14	10	3	—	1	—	—

Seed fuzziness.

	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
Parent progeny	1	5	7	8	8	3	—
5-3 line	—	—	13	23	5	1	—
5-3 selfed	—	—	11	13	13	13	2

As regards quality of fibre, this seemed to differ more with the parent progeny than in the two other populations.

The abundance of fibre, as expressed by the mean weight of fibre borne by 100 seeds, averaged 36.5 % greater than in the "bulk" or commercial stock (5-3 strain).

In the earlier years of breeding work, no special attention was given to the fuzziness of seeds; consequently it is not possible to establish the difference between the commercial stock as compared with the parent progeny. On the other hand, the frequency distribution of the parent progeny indicates that selection of a strain having smoother seeds than the present commercial stock is quite possible.

The question has been raised whether any new developments are possible. The reply is positive: there have been observed on "Pima" plantations certain heritable variations which, although rare and comparatively unimportant, certainly justify the continuation of selection work. Some examples will illustrate this fact. The boll of Pima cotton has usually 3 locks or carpels, although 4-lock bolls are borne by nearly all plants of this variety. As regards the proportion of 3-lock and 4-lock bolls there is much individual variation. The author conducted a series of investigations in order to ascertain whether such differences are heritable, and selected as a start several plants which had more or fewer 4-lock bolls than the average. Table III shows the percentages in the progenies of 3 of these plants (1918).

The differences appear to continue. Work was renewed in 1919 with selfed seed of one plant in progeny No. 3 and of 2 plants of progeny No. 1 (both with 4-lock bolls).

TABLE III. — *Percentages of 4-lock bolls in the progenies of individual plants selected in* 1917.

Progeny	Number of plants	Percentage of 4-lock bolls
No. 1 (from parent with few 4-lock bolls)	19	4.6 ± 0.031
No. 2 (from parent with many lock bolls)	22	5.9 ± 0.33
No. 3 (from parent with many lock bolls)	8	10.5 ± 0.67

TABLE IV. — *Percentages of 4-lock bolls in progenies of plants selected for a high percentage of 4-lock bolls.*

	1919			1920	
	Number of plants	Percentage of 4-lock bolls		Number of plants	Percentage of 4-lock bolls
1-3	13	8.5 ± 0.65	1-3-12.	45	9.2 ± 0.36
1-5	20	8.7 ± 0.54	3-2- 4.	39	22.0 ± 0.62
3-2	5	10.9 ± 0.87	3-2- 5.	42	23.3 ± 0.60
Total	38	9.1 ± 0.37	*Total*	126	17.2 ± 0.30
Commercial	38	4.2 ± 0.27	*Commercial*	50	5.3 ± 0.29

The results are therefore positive; it is evidently possible to obtain by selection an increased percentage of 4-lock bolls. These types would in all probability give a yield of fibre and seed 10 % superior to the ordinary stock.

Similar facts exist concerning the seed fuzziness, the development of the branches and flower stems, etc.

A very striking variation consists in the complete or nearly complete absence of the dark red spot near the base of the petals, which is normally characteristic of the Pima variety. An examination in 1919 of the 4-lock progenies (see Table IV, left) bears out this statement and was evident in 3 progenies.

The 38 plants inspected in 1919 were graded with respect to degree of development of the petal spot, grade 8 indicating the extreme development in typical Pima cotton and grade 0 indicating complete absence of the spot, as is the case in most varieties of American Upland Cotton (*Gossypium hirsutum* L.). Two or three flowers were separately graded on each plant; the total averages for the 38 plants is estimated at 1 ± 0.04 and for 13 typical Pima plants 7.5 ± 0.19.

The absence or weak development of the spot, in association with the 4-lock bolls, is clearly hereditary, and suggests the possibility that Upland cotton (*Gossypium hirsutum*) or Hinde cotton (*G. punctatum* Schum. and Thonn.) may have been involved in the remote ancestry of the Pima variety.

The fact that heritable variations are found in this apparently uniform variety is considered as justifying the continuance of selection and line breeding and the elimination of inferior individuals.

1106 - **Experiments on Flax Hybrids.** — BLARINGHEM, L., in the *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 5, pp. 329-331. Paris, August 1, 1921.

Varieties of flax grown for seed are much more homogeneous than those cultivated for their fibre and shew little degeneration In a genetic study of flax it is necessary to bring out the stability of the first type of plant, in order better to explain the irregularities and degeneracy of the second The author had the good fortune to obtain a line of " white seeded flax " characterised by ivory-coloured seeds and fruits with non-ciliate septa As it is very productive and homogeneous, this variety forms an excellent standard of comparison for the hereditary qualities of other types. The author gives the results of his experiment with " Morocco flax," which he believed to be homogeneous, but found, on crossing it with the white-seeded flax, that the hybrids formed a heterogeneous population possessing dominant characters.

The two types are distinct as regards all their most noticeable characters : —

	White seed flax	Morocco
Plant . . .	Slender, ramified from base, small (25 cm.)	Strong, unbranched, tall 40 (cm.)
Flowers	Light blue small (12 mm.)	Blue, large (25 mm.)
Fruits.	Small, depressed, white non-ciliate septa	Large, globular with ciliate septa
Seeds . .	Small (2-3 mm.), virgate, white	Large (5-6 mm.), oval, brown

Crosses are difficult to make ; of the 5 emasculated flowers on each stalk, the youngest always prove abortive ; one or two may set seed, but are often empty.

As regards the 1919 crop, 5 out of 12 *Moroccan* female parent plants (P_1 to P_5) bore respectively 6, 7, 5, 2 and 3 seeds, and 1 in 6 (P_6) of the *white seeded* variety produced 4 seeds.

The *White seeded* × *Moroccan* cross is more difficult to effect than the reciprocal cross, as the author also found in 1920 and 1921, the two types behaving from this point of view like distinct species (NAUDIN).

In the first generation the *Moroccan* characters are predominant. The progeny of a Moroccan female parent plant are all similar, tall (40 cm.), ramified at the base, bearing light-blue flowers (15 to 20 mm.), and oval, average sized fruits with ciliate septa. Seeds are rare, some are wrinkled, and germinate badly. P_2 which had produced 7 seeds was still the most fertile in F_1, bearing 125 good seeds; P_4 which had borne 2 seeds, produced 52 in the F_1 but half of them did not germinate. The cross P_6 (*White-seeded* × *Moroccan*) gave in the F_1, 2 low plants (22 cm. and 31 cm.) with a stalk which was much ramified throughout its whole length and this peculiarity persisted in the F_2. Examination of the second generation (1921) confirmed the theory that the *Moroccan* type was heterogeneous. The following Table shows some of the results of the segregation.

Line	Plants with White seeds	Plants with Grey seeds	Plants with Brown seeds	Fruits with non-ciliate septa	Fruits with ciliate septa
P1	3	13	14	12	18
P2	20	42	12	17	57
P3	20	27	14	13	48
P4	3	21	5	6	23
P5	8	17	9	12	22
P6	3	21	35	4	55

If the columns are added up, the figures do not give the mendelian ratio. Instead of postulating multiple factors, the author leaves on one side, as standards of comparison, the lines P_1, P_4 and P_6, only taking into account the results furnished by P_2, P_3 and P_5. These taken together, give a total of 121 plants with coloured seeds, as against 48 with white seeds, that is to say, 3 brown to 1 white. The individual deviations, which are still considerable, are of the type observed by TINE TAMMES in crosses between white-flowered and blue-flowered varieties of flax. The author states that they are due to the partial abortion of the seeds, which is a constant and very marked peculiarity of flax plants.

Limiting the investigation to the 3 lines in question, it was found, as regards the second group of characters, that there were 127 plants with ciliate septa, as against 42 with non-ciliate septa (ratio 3 : 1). It results from these data :— 1) That the brown colour of the *Moroccan* flax is dominant as regards the white of the white-seeded variety; (2) that ciliate septa in fruits are dominant as regards non-ciliate septa.

The author, however, deduces another important fact connected with the Moroccan type, which is in appearance vigorous and homogeneous, viz, some of the lines, when crossed with a clearly defined reactive type, behave as bearers of simple Mendelian characters, whereas others behave as bearers of complex characters.

Crossing with a selected reactive type therefore makes it possible to separate regular lines from an assembly in which all differences appears to have been lost, and the individuals seem precisely similar. This method, combined with the choice of lines producing ordinary pollen, forms the basis of the technique adopted by the author for flax selection.

1107 – **Association of Characters of Flax Varieties Selected at Verrières, France.** — See No. 1120 of this *Review*

1108 – **The Selection of *Hevea brasiliensis* in the Dutch East Indies.** — HEUSSER, C., in the *Archief voor de Rubbercultuur*, Year 5, No 6, p 332. Buitenzorg, June 1921

A nursery of *Hevea brasiliensis* was established in 1915 at the Bijawak farm with seed from 4 vigorous and highly productive female parent stocks. In September, 1918, a selection was made of a hundred female descendants :— 34 from parent I, 20 from parent II, 23 from parent III and 23 from parent IV. The following tests were made up to September, 1920 :—

1) Five tapping tests each lasting for a months.

2) Three determinations of the number of latex vessels.

3) Three determinations of the trunk circumference and the thickness of the bark at 1 metre from the ground.

The tapping experiments (on six year-old plants) showed, after eliminating all possible errors by calculation, an increase in yield, compared with the original plantations, of 16.8 % (reckoned on equal areas). On the other hand, in the case of individuals among the selected plants, the increase was as high as 75 %.

The descendants show a wide range of variation as regards productivity, and the genetic value of the females also varies considerably. In making choice of the latter it seems desirable to lay special stress upon a conjunction of vigorous growth with high productive power

It is also better in apportioning the descendants to have regard to the actual yield from the incisions than to the number of latex vessels. The degree of correlation between this value and the yield is not high, especially in the case of young plants.

1109 - **Commercial Production of Seed According to the Swedish Improved Method, and the Progress Already made in Canada and New South Wales.** — I. BREAKWELL, E., The Production of Better Seed in other Countries. *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt. 4, pp. 245-248. Sydney April, 1921. — II. NEWMAN L. H. (Secretary, Canadian Seed Grower's Association), Seed Centres in Canada. *The Agricultural Gazette of Canada*, Vol. VIII, No. 2, pp. 212-214. — III. CUTLER, G. H., The Beginning of an Important Movement for Supplying Pure Seed, *Ibid.* p. 151. Ottawa, March-April, 1921.

The improvement of cultivated plants and the commercial production of seed therefrom have been for some time vigorously undertaken by European countries, and also by America. The two nations outstanding in this respect are Sweden and Canada. The methods adopted in Sweden have served as a model for other nations and the author gives an account of the methods employed in that country.

I. SWEDEN. — The General Swedish Seed Company, a private commercial body for growing, treating and selling farm seeds in bulk, buys all the improved seed from the Swedish Institute at Svalöf for further commercial production. It extends further production on its own land, and also enters into contracts with private growers. The terms of contract are briefly as follows :—

1) The grower undertakes to grow the seed for the General Swedish Seed Company ; 2) The grower is bound to deliver to the seed company without remuneration the same weight quantity as received with an addition of 25 % ; 3) the grower is bound to deliver the entire balance of the crop to the seed company for a fixed remuneration ; 4) should the company be unable to accept the average quality sample which the grower is bound to send to the company the growers' obligation shall cease ; 5) the grower shall deliver the crop in clean condition ;

6) the grower binds himself to allow the seed company's representative to inspect at any time, and at the company's expense, the growing crop at any place ; 7) should the crop not be approved as seed goods by the seed company on account of faulty harvesting, bad smell, low germination, mixing with foreign sorts, disease, or other causes, and providing this is caused in any way by neglect or improper handling by the grower, he shall be bound, if so claimed, to pay for the seed he received at the price quoted for the goods in question in the year's catalogue ; 8) should the goods delivered be found not up to sample, or should they show upon closer examination that they do not reach the standard mark on the measure, and the goods thus be in any case unfit for seed, they will then be valued according to the mutual agreement of the grower and the seed company.

I. II. *Canada* (1). — It seems practically certain that this method served as a model for Canada. A Canadian Seed Growers' Association was founded in 1900.

The Association appoints provincial officers for field inspections, and its own officers for the final inspection in the sack. The method adopted is as follows : —

1) Membership is open and free to any *bona fide* farmer who has shown himself capable of producing improved pure seed ; 2) the farmer who undertakes to grow pure seed obtains his foundation stock from the association. Such seed is either " first generation registered seed " (*i. e.* F_1, F_2 or F_3 progeny of an improved selected strain) or *élite stock seed* (*i. e.* pure stock of seed originating from a single plant, or obtained from a hand selected seed plot) ; 3) any seed of any kind of crop produced or selected by a member during the succeeding years is entitled to registration by the association ; 4) certificates are given : (*a*) for seed grown according to regulations and recovered from élite stock seed, such seed being marked *registered seed* and (*b*) for pure élite stock seed ; 5) no certificates are issued unless the seed be (*a*) pure as to variety and true to type ; (*b*) free from seeds of other cultivated plants ; (*c*) free from seeds of weeds coming within the meaning of the term " noxious weeds " as applied to the Seed Control Act ; *d*) free from or containing not more than a total of one seed of other weeds of minor importance ; (*e*) well-matured, clean, sound, plump, of good size and colour, and free from disease ; *f*) up to the percentage standard of vitality recognised for good seed of the kind under the Seed Control Act.

II. The methods thus outlined are extremely successful and are well supported, and at present the demand for " registered seed " is greater than the supply. For example the Canadian Seed Growers' Association is endeavouring to assemble in Ontario a number of carloards of registered Banner oats, but the supply to meet the ordinary demands of the trade is inadequate : the author considers that at least one good seed producing centre should be established in each district where high class seed of the kind most in demand may be produced to a high degree of perfection and in considerable quantity.

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(1) See *R.* March 1921, No. 280. (*Ed.*)

Prof. CUTLER states that during the past 3 years the Department of Field Husbandry of the University of Alberta has been putting forth every effort to standardise and purify old varieties and breed new varieties of the diverse farm crops. During that time there has been an insistent and steady demand for pure seed representing suitable varieties, and for information as to how " registered seed " can be obtained or produced. In answer to these applications, samples have in nearly every case been sent out; the size varying from a few ounces for testing to 3 bus. or more for multiplication. During the past 2 seasons, over 1500 samples of seeds were placed in the hands of interested seed growers who are undertaking to test and multiply given improved and purified strains of the different farm crops. This is the beginning of a very important movement in seed production in Alberta, but necessitates special organisation. In meeting adequately therefore the needs of the farmers' demands, the University of Edmonton is prepared to coordinate all co-operative seed testing, seed distribution, and multiplication work under one organisation to be known as the " Alberta Crop Improvement Association ".

I. NEW SOUTH WALES. — The Department of Agriculture has already taken the initial steps for the production of better seed. The method adopted differs from those in Canada and Sweden in the fact that the Department deals directly with the farmers. It is interesting to note that a list of growers of pure seed of good quality of wheat, oats, maize, sorghum, Sudan grass, potatoes and other crops is published in the *Agricultural Gazette of New South Wales* monthly, in order to enable farmers to get into direct touch with reliable sources of supply of such seeds. The list is compiled after inspection of the seed and report by a field officer (preferably during the growth of the crop), and farmers who have pure high-class seed of good quality of any variety of farm crop are invited to communicate with the Department of Agriculture, Sydney.

1110 - **Comparison Studies of the Resistance to Lodging of Several Pure Bred Wheat Varieties.** — DRAGHETTI, A. (R. Laboratorio autonomo di chimica agraria, Forlì), in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Pts. 4-6, pp. 145-180, fig. 1, bibliography of 21 works. Modena, 1921.

For general purposes it is possible to distinguish at least 3 characteristic forms of lodging, to be attributed: 1) to excess of nitrogen; 2) to weather conditions; 3) to a lack of uniformity of the stem.

Practical experience has led to the classification of the varieties most liable to lodging, even under normal conditions; it is therefore possible to make a distinct classification of wheat varieties. This may be attributed to the fact that different types present marked and constant differences as regards the equilibrium of the stem. For this reason it is possible to make investigations with a view to the discovery of the weak side of their morphological structure.

The author was not content to rely on empirical observations for the investigations described in minute detail in the present article, but rather on the statistical biometric method by which means he aimed at the solution of the following problems.

1) To find a positive or negative value attributable to different varieties, under fixed biological cultural conditions in order to facilitate the establishment of a rational gradation with respect to lodging;

2) To find and evaluate the positive and negative characters which should serve as a guide in selection work;

3) To trace the outline, from the statistical standpoint, of a typical plant free from the inferior qualities associated with the breed.

A selection of varieties of cultivated wheats was made with a view to conducting comparative adaptation trials at the Experiment Farm at the Forlì Agricultural Station, on clay loam, following on beets; the ordinary fertilisers and cultural operations being in every case employed.

For each stem the author determined (from May 10 to 20): 1) weight; 2) height to top of ear; 3) height from centre of gravity, taking into account the influence exercised by the varying lengths and thickness of the upper leaves; 4) length, weight, diameter and thickness of the epidermis of each internode; 5) weight, in grammes, determining the break due to bending of the lower portion of each internode and for a bract of 10 cm.; 6) submission to bend up to limit of breakage in cm., and angle of inflexion in degrees. For determinations 5) and 6), the author has invented an apparatus which is described and illustrated.

The biometrical data obtained serve as a basis to estimate the mean and to deduct the coefficients of variability by applying the GAUSS formula.

In this way a marked positive correlation has been established between the unit weight of the internode and its resistance to bending.

The data obtained concerning the average degree of bending of 10 varieties studied, permit the conclusion that a characteristic elasticity exists for each and this factor is a point of considerable importance. As a matter of fact, their progressive value is in perfect correlation with the gravity of lodging observed in the plots concerned, for example:

Inflexion. 1st Internode	Cultural observations
4.8 a 5.9 cm.	Stems completely resistant
7.3 a 8.6 »	» partly liable to lodging
8.8 a 9.0 »	» completely beaten down.

Flexibility of stems is therefore a character which should be taken into consideration as much from the practical (comparatively thick sowing) as from the experimental point of view.

[1110]

Formulae have here been established, criticised and developed, relative to the calculation of moments of inactivity, of resistance and of unit coefficients of breakage ; this is followed by observations with reference to the extrinsic or local mechanical factors : *a*) pressure due to the force of wind ; *b*) pressure due to the displacement of the centre of gravity from the vertical ; *c*) pressure due to adhesive raindrops. Determinations are made as to the statistical equilibrium and the balance between positive and negative pressure of the stem and an examination of the differential mechanical characteristics attached to the varieties studied.

Taking the " index of resistance of lodging," to indicate the relationship between the pressure of resistance and the pressure of flexion for each variety, in such a manner that the equilibrium be represented by unity, the positive resistance by a number superior to 2 and the negative resistance by a value inferior to unity, the following values will be obtained: Rieti fam. 11 : 1.026 — Gentil rosso fam. 48 : 1.002 — Cologna fam. 12 : 0.881 — Inalletabile fam. 38 : 1.232 — Carosello fam. 91 : 1.052 — Masolino fam. 33 : 0.981 — Coronation : 1.309 — Apulia : 0.818 — Luigia Strampelli : 0.950 — Dauno : 0.877.

Supposing that the more forcible pressures of total resistance or total deflec-tion be taken as equal to 100, the author calculates that this may be sub-divided into 3 part time pressures due to wind, to displacement of centre of gravity and adhering raindrops. The results are shown in tabular form, and permit the following conclusions :—

1) That the force which is the chief cause of distorted development even for varieties with a very flexible stem, is in all cases the wind, which possesses an influence coefficient varying from 64.3 to 83.7 % for total deflection.

2) That the sum of the coefficients of wind effect and displacement of centre of gravity is very nearly constant, *i. e.* the coefficient of wind effect is inversely proportional to stem flexibility, whilst the coefficient of effect of deviation from the centre of gravity is directly proportional to it.

But these relations have only an approximate value ; the only one having any absolute and specific value is that arising from the results of comparison of the index numbers concerning moments of resistance and total deflection.

The statistical ratio of the stem is given by the formula

$$\pm M = \frac{KI}{z} \overset{<}{\underset{>}{=}} \left(0.57 \frac{A+a}{z} p.\, h\right) + [(P + P_1)\ h_1 \text{ tang } \alpha)]$$

when K indicates the unit effect of the elements chiefly concerned with the section of the stem ; $\frac{I}{z}$ the moment of resistance of the joint of node ; *A* and *a* the portion of the stem and sheath affected by the wind ; *p* the unit of wind force ; *h* the height of the vertical projection of the stem ; P the weight of the stem and P_1 the increase in weight owing to the rain , h_1 the height of the centre of gravity and the angle described by the new position of the abnormal stem in conjunction with its original position.

In this case, the values K, $\frac{I}{z}$ and h represent characteristics of particular types, upon which depends the degree of resistance to lodging of different varieties of wheat. The means available in order to procure the most advantageous combination of the 3 above-mentioned factors are of both a practical and biological nature. Belonging to the first group may be mentioned the earthing up of wheat which causes a decrease in h and which, if somewhat thickly sown or in well spaced lines, increases K and $\frac{I}{z}$; in the second case, the only methods which can hope to solve the problem definitely are associated with pure line selection and hybridisation. The results obtained recently are very encouraging as to the possibilities of arriving at the solution of the problem of lodging and increase in yield.

1111 – **Experimental Cultivation of Foreign Wheat and Oats in Italy.** — POGGI, G. in *Il Coltivatore*, Vol. 67, No. 24, pp. 177-181, 4 figs. Casale Monferrato, August 30, 1921. — ROSSI, G., in the *Rivista di Agricoltura*, Vol. XXIV, No. 34, pp. 181-182. Piacenza, August 26, 1921.

I. — M. POGGI describes the good results he obtained with foreign wheats and oats sown broadcast in March in very stiff, clay-loam, hill soil with an average amount of fertiliser. The year being a wet one greatly contributed to his success. Among the wheats, the best results were given by Marquis and April Bearded Wheat, both proving resistant to lodging.

The oats sown were as follows :—

GARTON'S " Record," an English variety with erect, stiff straw, and panicles containing 220-250 white, full, heavy kernels. It ripened somewhat late (perhaps because it was sown in the spring) ; it is rust resistant.

Prolific Black Tartarian, which gave the maximum unit yield. Its straw is of average length ; the panicles are very large ; kernels black with white tips. " Green Mountain," a variety from the United States, proved resistant to drought. Its straw is very stiff, the panicles attain the length of 40 cm., and the kernels are inflated and very white.

" The Hero " is another of the GARTON varieties, its straw is very stiff and its panicles enormous ; the kernels are white and heavy. " The Yielder," another GARTON product, ripens a little earlier.

The " Great Lizo, " originally a Canadian variety, proved to have very strong straw, large compact panicles, and large inflated kernels. The Swedish varieties " Suédoise selectionnée," and " Iowa 105," although sown in the spring, ripen at the same time as the autumn-sown native oats, which makes them much prized in districts which are usually dry. Their straw is strong, the panicles are very lax, and the kernels somewhat small.

II. — Dr. Rossi has introduced into Italy many varieties of wheat including the " Reliable," bred in the United States by A. Read. In the north of that country, it is a winter wheat; in Italy it does best when sown as early as possible in the autumn.

In the district of Sienna, this wheat has grown well on estates at an altitude of 400 metres. In the experiments made in 1920-1921 by the " Cattedra ambulante d'Agricoltura di Pisa " at Cecina, this variety gave the maxima unit yields. The author suggests that it should be tried in the different regions of Italy.

1112 – **Experiments in Cereals Cultivation Carried out by the " Istituto agrario provinciale di San Michele ", Trent.** — Springhetti, in the *Bollettino del Consiglio provinciale d'Agricoltura*, etc., Year XXXIV, No. 16, pp. 229-230. Trent, August 31, 1921.

During the agricultural year 1920-1921, the Provincial Agricultural Institute of San Michele all'Adige (Trent) tested the three varieties of wheat " Gentil rosso," " Carlotta Strampelli," and " Conte Piatti," by growing them under the most suitable conditions as regards situation, quality and richness of soil, preparation of the ground, and choice of fertilisers. " Conte Piatti " is an awned wheat especially suited to hilly country and is resistant to drought and frost.

The seed was sown in the first fortnight of October, in soil dressed with 6 quintals per hectare of superphosphate + 2 quintals per hectare of potash salt. The wheat followed potatoes or maize, preceded by red clover or lucerne; " Carlotta Strampelli," however was sown directly after the clover. " Gentil Rosso " was sown on three plots, and " Carlotta Strampelli " and " Conte Piatti " on a plot each. The respective yields of the plots were 35, 29.4, 34.32, 28, and 31.37 quintals per hectare, the general average being 31.61 quintals per hectare.

As the local farmers never succeeded in obtaining more than 15 quintals per hectare, the above crops, which were the result of the careful following of known rules, show that it is possible to increase the agricultural production of a region simply by means of a suitable rotation, proper preparation of the ground, sowing seed of good quality, and the systematic application of a fertiliser.

1113 – **The Transplanting of Rice, and the Production of Seed Rice in Italy.** — Chiappelli (Relatore, R. Stazione sperimentale di Risicoltura e delle Coltivazioni irrigue, Vercelli), in the *Giornale di Risicoltura*, Vol. XI., No. 7, I, pp. 105-109; II. pp. 110 112. Vercelli, July 31, 1921.

I. — Report of the Prize Competition, opened in 1920, by the " R. Stazione Sperimentale di Risicoltura " of Vercelli, with the object of encouraging the transplanting of rice, and the production of two crops in the year. The following facts are deduced from the results obtained by the rice-growers who took part in the competition.

The increased unit return, and the yield of the preceding crop, after deducting the transplanting expenses, gave a large margin of profit. Mechanical ploughing, by leaving the teams free at the critical moment when they were needed for other crops, has greatly contributed to the development of transplanting, so that, on some farms, it was practised on ½ of the area under rice.

Most of the transplanting is effected in new rice-fields which allows of a good hay crop being obtained the same year, but it is also practised after rye, or rape grown for seed, or after wheat harvested at the, beginning of July, the early Dellarole variety of rice being transplanted towards the middle of the month. An interesting experiment was made at Morimondo (Abbiategrasso district, Province of Milan) by M. TAGLIABUE, who transplanted rice after having obtained a good crop of grass, and bred mirror carp in the rice-field (1).

The average increase in the return obtained by transplanting the rice, as compared with the ordinary method, was from 7 to 8 quintals per hectare. In addition, the kernels were heavier, and the panicles ripened more uniformly. Therefore transplanting is much to be recommended, especially for seed-rice.

II. — Report of the Prize Competition opened in 1920 by the "R. Stazione sperimentale di Risicoltura" of Vercelli for the rice-growers who were most sedulous in the field selection of seed-rice.

The keenest farmers carry out 3 successive selection operations in the field, removing any panicles that are mal-formed, or belong to other varieties, and thus prevent all chance of degeneration. The seed used for these fields of selected rice is usually hand-picked in the selected fields by expert workers, who choose, panicle by panicle, the kernels that are finest and largest, and borne by vigorous plants that give good yields.

The CABRINI method of cultivation (2) gives good results in producing seed-rice, plants thus obtained being vigorous and productive, with well-shaped and well developed panicles and large heavy kernels; in addition they were more resistant to lodging.

The crops obtained from transplanted rice were also most satisfactory.

1114 - **Experiments in Lentil-Growing in Upper Italy.** — BONASERA, G. (R. Istituto tecnico di Novara) in *Giornale di Agricoltura della Domenica*), Vol. XXXI, No. 36, p. 286. Piacenza, September 4, 1921.

The author, having noticed for some years that lentils were not much used as an article of human food in Upper Italy, and hence little grown in fact, attempted to find out whether this neglect was due to unfavourable conditions of soil and climate. He found that the conditions obtaining were in fact most suitable to the lentil.

By sowing lentils in the experimental kitchen-garden attached to the "Scuola di Agraria e Estimo" of the Royal Technical Institute

(1) See *R.* April 1921, No. 422. (*Ed.*)

(2) See *R.* April 1921, No. 457; *R.* June 1921, No. 624. (*Ed.*)

at Novara, at the rate of 1.18 hectolitres per hectare, and cultivating it in the usual way (which he describes), the author obtained 20 times the seed used, that is to say, 24.62 hectolitres of seed, and 18 quintals of straw per hectare, which at present prices, leaves a considerable margin of profit. From an investigation of the data furnished by several workers (A. FELCINI, *Lezioni di agraria*, Vol. II, Jesi, 1918; C. LUMIA, *Estimo rurale* 3rd edition. Catania, 1919), the author discovered that the ratio of the money value of the gross return, to production cost is as 1 : 0.73 for pulse crops.

In order to protect .lentils against *Bruchus signaticornis*, they should be sterilised by heating to about 100° C. They must be placed in thin layers, and carefully turned over.

Some investigators object to this treatment, alleging that it makes the lentils difficult to cook, but the author shows from the results of his own experiments, that there is no foundation for this statement.

1115 - **Cultivation of "Dolic" in the Open Field.** — MANVILLI, V., (Istituto Agricolo Bonafous di Lucento, Turin), in the *Giornale di Agricoltura della Domenica*, Vol. XXXI, No. 19, pp 147, 2 figs. Piacenza, May 1921.

The general name of " dolic " is applied to 3 species, each containing several subspecies, viz., 1) *Dolichos sesquipedalis* (asparagus Dolichos); 2) *Dolichos Catjang*, or *Vigna Catjang*; 3) *Dolichos unguiculatus* or *Vigna sinensis*, known as the cow pea, unguiculate Dolichos, or Blackeye. The last group is the one most cultivated in the United States and in South Europe (Greece, Italy, Provence, Spain and Portugal). In the United States, it has spread rapidly throughout the wheat belt. The best *forage* varieties grown there are:— Whip poor Will, Iron, New Era, and their hybrids Brobham, and Groit, and those most suited for *human consumption*, are, Couch, Cream, California Blackeye, Extra Early Blackeye, etc.

When cultivated for seed, the cow-pea is grown like the French bean with the same rotation, fertiliser, and treatment, and like it is sown from 4-6 cm. apart, with a space of 80-90 cm. between the rows. If intended for forage, it is grown as a catch-crop, and broadcast at the rate of 80 to 120 pounds per hectare, the seed being covered by means of a cultivator, or harrow. In order to obtain a large amount of forage for silage, the cow-pea is associated with Caragua maize, millet, or amber sugar-sorghum, being sown broadcast between the rows of the cereal.

An excellent combination for hay production, or pasture is cow-pea grown with soja (*Soja hispida*), as was discovered by the author in his experiments at the Agricultural Institute of Lucento (Turin). Twice as much seed is needed for the latter crop as for the former, and a variety of soja with strong stems must be chosen, in order that it may act as a support for the cow-pea. The hay thus obtained is very nourishing.

1116 - **Pearl Millet (*Pennisetum spicatum*) in Brazil.** — GABBATO, C. (Experiment Station of Viamão, Brazil), in *L'Agricoltura coloniale*, Vol. XV, No. 7, pp. 372-373, 1 table. Florence, July 1921.

The author has grown pearl millet (*Pennisetum spicatum*) at the Experiment station of Viamão (Porto Alegre, Rio Grande do Sul, Brazil), from seed obtained from the United States. This forage Graminea, although of African origin, did very well in Brazil.

It grows rapidly and attains a height of 2 to 5 metres. Cattle and horses eat it readily both when fresh and made into hay. The hay takes rather long to make, as the culms of pearl millet contain a great deal of water (75 to 80 %).

The highest yields are obtained on rich, alluvial soils, but it will grow on most soils. The seed-bed is prepared in the same way as for maize, and the millet is sown in the spring, from 80-90 cm. apart, the distance between the rows being 15 cm. About 4 kg. of seed is thus used per hectare. Should the pearl millet be intended for hay, it must be sown closer or broadcast, in order to prevent the culms becoming too thick. From 2 to 5 cuttings a year can be obtained, according to the dampness of the soil. In order to encourage the millet to throw up fresh stems, it must be cut to within 10 to 15 cm. above the collar.

A plot sown on Nov. 17, 1920 at Viamão, was ready for cutting the first time on February 23 (although the season had been somewhat dry), and yielded 49 285 kg. of green forage per hectare.

1117 - ***Bromus brachyantheca*, a Brasilian Winter Forage Plant.** — De Arruenda, J. M., in *Chacaras e Quintaes*, Vol. XXIV, No. 2, pp. 97-98. São Paulo, August 15, 1921.

For the last 5 years, the author has been growing in the State of Santa Caterina, Brazil. a *Graminea* for winter forage at an altitude of 4000 feet. The plant, which he found wild in his fields has been indentified by Dr. Kuhlmann (Agrostologist), as *Bromus brachyantheca* Doell. The author states that this grass is resistant to cold, ànd that he is well satisfied with the good crops he has obtained.

1118 - **Experiments in Growing Lucerne on Dry Soils in Italy.** — *Il Coltivatore*, Vol. 56, No. 21, pp. 81-83, fig. 1. Casale Monferrato, July 30, 1921.

It is generally believed that Gramineae are the best forage plants for cultivation on dry soils. Dr. A. Mannarini, Director of the Cattedra ambulante di Agricoltura di Lecce, has, however, demonstrated that certain varieties of lucerne, such as the Peruvian and Arab varieties which have been widely tested in the United States Agricultural Experiment Stations, succeed very well in the district of Lecce. Of the other Leguminosae which he tried, *Trifolium alexandrinum*, and the kidney vetch (*Anthyllis vulneraria*) gave a negative result. The substitution of Leguminosae for Gramineae as forage plants is a very important matter, for the former enrich the soil, whereas the latter impoverish it. Further, the nutritive value of Leguminosae as a fodder is much higher than that of Gramineae.

On January 10, 1920, Mannarini sowed the Peruvian, Arab and ordinary varieties of lucerne for purposes of comparison. The first cuttings, on May 30, amounted to 155, 102 and 49 quintals per hectare, respectively. From that date, until the beginning of September, there was a persistent drought; nevertheless, the two first varieties were ready for cutting a second time, whereas the growth made by the latter was entirely negligible.

1119 - **Dolic as a Forage Crop.** — See No. 1115 of this *Review*.

1120 - **Experiments in Flax-Growing in France.** — De Vilmorin, J., in the *Comptes rendus de l'Académie d'Agriculture*, Vol. VII, No. 6, pp. 397-403. Paris, April 27, 1921.

With a view to intensifying flax cultivation in France, the Interministerial Flax Commission appointed by the decree of January 24, 1918, decided in conjunction with an Agricultural Sub-Commission of which the author is a member, to plant experiment fields with the flaxes grown in 1918 in the collection of Messrs Vilmorin.

In 1920, three types of flax were sown at Verrières in plots of 1 sq. m. on Apiil 1, 2 kg. of seed being used per are (100 sq. metres). The collection consisted of 63 varieties.

Subsequently, the Agricultural Office for the Northern Region decided to establish an Experiment Station at Vattetot-sous-Beaumont near Goderville for the improvement of flax in the Seine-Inférieure. To this Station, which was under the direction of M. Thierry, the author sent 100 gm. of the seed of each of the varieties of flax that were considered the best at Verrières.

The straw of these different kinds was sent to the Manager of Messrs. Feuillette's factory at Goderville, who reported upon it as follows :—

Tensile strength. — This was high, and nearly equal in all the samples of tow; No. 269 (common variety with white flowers) was however a little inferior in this respect to the others.

Length. — Almost all the varieties were of good commercial length, 70 to 90 cm., only a few being too short and therefore excluded. Other qualities being equal, a flax of 60 cm. is worth about 25 % less than one of 80 cm. On the other hand, Nos. 228 (Pskoff flax, Verrières line) and 241 (selection 1803, Washington), which are over a metre in length, are a litt.e too long.

Quality and commercial value. — The tow is usually coarse, and harsh to the touch. If we class a 1914 sample of flax from Caux at 20, as representing the best Courtrai quality, the following varieties may be placed in the first class :— Nos. 228 (Pskoff, Verrières line), 241 (Selection 1803, Washington), 270 (with yellow seeds, Verrières line), and 232 (Japanese D. D. Leitch) as having sufficiently flexible straw to make fairly fine warp threads, probably No. 60, which on account of their textile strength, should comb well. This quality would certainly be much appreciated at the spinning-mill, and such flaxes would have a ready sale, and are marked 15. Nos. 228 and 241 have yielded respectively 231 and 209 gm. per square metre, which would mean a large return per hectare.

The second class includes the fairly good qualities marked 12 to 9; they are in order of merit, Nos. 223. 229, 238, (Dakota No. 52), 240 (Dakota No 114), 231, 242, 243, 245 (Irish flaxes, Feuillette group). In the third class, there follow in descending order, Nos. 293 (Dutch with white flowers), 253, 224 227, 247, 248, 267 (Royal with white flower), 268, 244 (No. 5 Irish, Hunter's Selection) and 225; all these flaxes are marked 8 to 7 as their fibres are strong and coarse. The fourth and last class consists of the "too short" groups with the exception of No. 235 (Canadian, Crawford), which is second to none in quality, and would be ranked among the best flaxes, if it were 75 cm. in length

Flaxes No. 228 (Pskoff Verrières line), and No. 241 (selection 1803) belong to the most approved industrial type as they strip and ret well. The Manager of the Goderville factory considers them superior to all the other kinds from the point of view of tow production.

The winter and spring flaxes from the district of Cremona, Italy, which are very short but of fine quality, proved unable to withstand the cold of the Parisian climate. They were tested in the south-west of France by the Director of the Agricultural Services at Mont-de-Marsan, but only one escaped injury by frost, resisting a temperature of −10° C; this survivor presented a flourishing aspect in April.

The collection being a large one, the author was able to make some genetic observations

Correlation does not always exist between the colour of the seeds, flowers, and pollen.

Most brown-seeded varieties have blue flowers and pollen, but there are also plants with brown seeds, white flowers, and blue pollen, while others have brown seeds, blue flowers, and yellow pollen. On the other hand, plants with yellow seeds and yellow pollen invariably bear white or pink flowers, or else flowers tinged or veined with blue.

In reply to M. HITIER's questions, the author states, that as a rule, the seed-yield is not correlated with the value of the tow. The Goderville hot-water retting process is used. Flax is grown at Verrières for its fibre and not for seed to supply the oil factories. Nevertheless, the author is of opinion that France, and Western Europe in general could grow flax yielding as good a linseed oil as any produced in Russia.

1121 - **Hemp Stalks As a Raw Material For Paper Manufacture.** — RASSOW, B., and ZSCHENDERLEIN, A., in the *Zeitschrift für angewandte Chemie*, Year XXXIV, No. 41, pp. 204-206. Leipzig, May 24, 1921.

A chemical study dealing with the use of hemp-stalks as a cellulosic raw material.

According to SCHWALBE and BECKER, the bast fibres of hemp contain 51.7 % of cellulose; the authors show that this figure is too high, probably because what the former investigators call "pure cellulose" is in reality mixed with lignin.

The authors have analysed two different samples of hemp fibre (the first obtained by ordinary retting and the second by retting in a 10 % solution of sodium carbonate. Carrying out the process used by SCHWALBE, but adopting more accurate methods of analysis, they found the percentage composition of the dry matter to be as follows:— Ash 1.25, 1.51; fats and resins 2.85, 4.26; furfurol 14.18, 14.37; pentosans (including those of the crude fibre) 40.57, 40.43; lignin 23.33, 22.08.

In order to obtain a cellulose free from lignin and oxycellulose, the crude fibre must be treated with chlorine (1 or 2 bubbles passed through per second for periods of half an hour), the product being washed each time with a 1 % solution of caustic soda, which is preferable to sodium sulphite.

Hemp bast, when heated for 12-13 hours at 140° C.-150° C with 4 % sulphite yields a paper pulp, which bleaches well, is of good appearance and contains 93 to 94 % of crude cellulose, with 10 % of pentosans. The results obtained with more concentrated solutions of sulphite were less satisfactory.

A product richer in pentosans can be obtained by other methods.

The composition of the stalks of flax and of hemp is very similar, but the first have a smaller pure cellulose content (37.05 as against 40.57 %). Hemp stalks are thus more suited than flax as raw material for making paper paste.

Coniferous timber contains much lignin and few pentosans, thus being just the opposite of the wood of dicotyledons. The authors suggest that perhaps pentosans are intermediate products in the natural synthesis of lignin.

1122 - **The Aromatic Plants of Algeria.** — BATTANDIER, J. A., in *La Parfumerie Moderne* Year XIV, No. 6, pp. 109-111. Lyons, June 1921.

Climatic conditions in Algeria are particularly suited to the cultivation of aromatic plants though up till now the industry has made very little progress. Many of the plants which abound in Morocco (1) are also found in large quantities in Algeria, but in addition to these, others are here enumerated and the list as it stands includes the following :—

RANUNCULACEAE. — *Clematis vitalba* and *Ranunculus bullatus.*

CRUCIFERAE. — *Matthiola* spp. and *Cheiranthus* spp. etc.

VIOLACEAE. — *Viola odorata.*

GERANIACEAE. — *Pelargonium* spp.

RUTACEAE — *Ruta montana, R. Chalepensis* amd *R. bracteosa* (high methylheptylic and methylnonylic cetone content), *Haplophyllum* (*Aplophyllum*) *tuberculatum.*

AURANTIACEAE. — These are more utilised for their fruits than for aromatics but exception is made in the case of Citron and Bergamotte.

ANACARDIACEAE. — *Pistacia Lentiscus* L. and *P. Terebinthus* L.

LEGUMINOSAE. — *Retama Bovei,* abundant in Ain Tédélès near Mostaganem, easily cultivated and forms well developed bushes, *Spartium junceum, Melilotus macrocarpa* DR., *Acacia Farnesiana* and other *Acacia* spp.

ROSACEAE. — Roses are grown only for their flowers, *Prunus Laurocerasus* (= *Cerasus Laurocerasus*), for distillation, apricots, plums, Japanese medlar, etc. for benzoic aldehyde.

MYRTACEAE. — *Myrtus* spp., *Melaleuca* spp., *Eucalyptus globulus.* Some years ago several tons per annum of Eucalyptus essential oil were produced but the industry has gradually died down and the old *E. globulus* trees have been utilised during the war as wood fuel for railway trains.

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(1) " Aromatic Plants in Morocco ". See *R.* Nov.-Dec. 1920, No. 1115. (*Ed.*)

CUCURBITACEAE. — *Cucumis* spp

UMBELLIFERAE. — *Ptychotis ammoides,* abundant on the plains, *Pt. atlantica,* — rare. *Coriandrum* spp. *Daucus Rebondii* Cosson, rare (odour of aniseed), *Ammodaucus leucotrichus,* abundant in the Sahara.

RUBIACEAE. — *Asperula odorata* — forests of Babors.

COMPOSITAE. — *Artemisia Herba-alba,* abundant on the Hauts-Plateaux, *A. atlantica* Cosson, on the mountains in the South. *A. arborescens, A. absinthium,* var *atlantica, Warionia Saharae* Cosson and Beutham, *Pulicaria Mauritanica* Cosson, *Periderea fuscata, Rhaponticum acaule.*

OLEACEAE. — *Jasminum* spp.

ELAEAGNACEAE. — *Elaeagnus angustifolia.*

LABIATAE. — *Lavandula Stoechas, L. dentata,* and *L. multifida, Mentha* spp., *Thymus* spp. *T. Fontanasii,* abundant in the Dahra and elsewhere, *T. capitatus, Origanum floribundum, Rosmarinus officinalis, Melissa* spp., *Calamintha* spp., *Salvia officinalis, Zizyphora hispanica, Saccocalyx* spp., *Satureia* spp.

VERBENACEAE, *Vitex agnus-castus, Lippia Citrodora* (cultivated on a large scale at Boufarick).

LAURACEAE — *Laurus nobilis, Cinnamomum Camphora.* Camphor promises to be a rising industry in Algeria. M. TRABUT has grown camphor from seeds obtained from Formosa with complete success, the camphor being of equally good quality as that produced in Formosa.

CONIFERAE. — *Cedrus* spp., *Pinus halepensis, Juniperus nana, J. thurifera.*

AMARYLLIDEAE. — *Narcissus* spp., *Polianthes tubcrosa.*

IRIDEAE. — *Iris stylosa, I. palescens, Freesia* spp.

LILIACEAE. — *Asphodelus acaulis, Lilium Candidum, Smilax* spp.

ORCHIDACEAE. — *Aceras anthropophora, Spiranthes autumnalis, Orchis fragrans.*

The author admits that this list is doubtless incomplete, but considers that it includes practically all the plants at present utilised for aromatics in Algeria.

1123 - **Improvement in the Cultivation and Yield of the Walnut Tree in France.** — I. FAUCHEON C., in *L'Alimentation moderne et les Industries annexes*, Year XIX, New Series, No. 16, pp. 233-238, 1 diagram Paris, July 1921. — II. RIGOTARD, L. (Agricultural Engineer, Agriculturist at Chantesse Isère), Préparation des noix pour le commerce, in the *Annales de la Science Agronomique*, Year 38, Series 6, No. 1, pp 1-9. Paris, January-February 1921.

On the average, the annual walnut crops of the chief producing departments (Charente, Corrèze, Dordogne, Isère, Lot) may be estimated at 350 000-360 000 metric quintals. The so-called " Grenoble " and " Cerneau du Dauphiné " varieties are especially celebrated.

Table walnuts are grown on both banks of the Isère, in the Saint-Marcellin district; the " Mayette " variety from Moirans to Vinay; the " Parisienne " from Vinay to Saint-Marcellin, in the plain on the left bank of the river; the " Franquette " on the slopes of the right bank, and the " Chaberte ", or " commune ", on the Bizoir plateau from Voiron to

Lyons. The selected kernels (*cerneaux secs*) of the ordinary variety are sold, packed in cases of 25 kg., to confectioners. The Department of Corrèze (and chiefly the Cantons of Messac and Beaulieu, Brive district) produce dessert walnuts and oil-yielding walnuts.

In normal times, the consignments are dispatched chiefly from the Stations of Brive, Objat, Agyen-Juillac, Turenne, Quatre-Routes, Vayrac, Bretenoux and Tulle.

In the Dordogne, the nuts are gathered, when semi-hard and quite hard. The first are sent to the oil factories, the favourite varieties being "Nogarelle", large well-shaped nuts, "Redon de Montignac", and Noix de Brantôme, which are of average size and first quality. Of the hard-shelled varieties, only one "Conturas", or "Conduras", known also as "Corne de mouton", is exported. This is an excellent dessert walnut, coming principally from the Sarlat and Périgueux districts.

The chief walnut-growing centre in the Department of Lot is around Gourdon, which produces about 140 000 quintals.

TREATMENT OF THE WALNUTS WHEN GATHERED. — In order to free the nuts from the fleshy mesocarp, they should be piled up in a sheltered damp place. Here the walnuts finish ripening, and the mesocarp rots, so that it is easily removed, and the nuts are spread out in a thin layer, or dried in a current of air. They must be turned over several times a day, especially when they are damp.

The machines sometimes used to extricate the nuts are often defective and work too roughly.

When the mesocarp has not rotted off, it is removed to some extent by hand, and the nuts are then plunged into a corrosive solution, which removes the last traces of their green covering ; and are subsequently carefully washed to free them from all trace of acids (1).

When hulled, the nuts are washed and brushed, but are not kept long in water for fear of spoiling the kernel ; they are subsequently dried on screens, being often turned over

At Saint-Quentin-la-Rivière (Isère), a hot-air rotary drier has been installed, which makes the drying operation more rapid and regular. Nuts thus treated remain fresh, heavy, and very clean, and have a good colour.

In the Dauphiné region, walnuts are not usually treated with sulphur, through they are in the Bordeaux district. The operation must be carried out before the walnuts are perfectly dry, but is omitted in dry seasons, when there is no fear of mould. It is perfectly innocuous. At Bordeaux, the nuts are treated with sulphur at once after they are gathered, so as to take advantage of their rather damp condition which makes it unnecessary to wet them further. As soon as the sacks of walnuts arrive, they are placed in a good sized tank, which is completely covered, no opening being left. In the centre of the tank, sulphur-candles are lighted, the number depending upon the quantity of sacks to be fumigated.

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(1) At the Second International Congress for the Suppression of Adulteration held in Paris in 1909, a vote was passed prohibiting the use of acids for this purpose.

In order to remove the particles of mesocarp, the walnuts can be brushed under water, or else, which is preferable, exposed to the action of steam for 1 or 2 minutes, then rapidly brushed under very hot water to which has been added 1 to 2 % of carbonate of soda.

Experiments made of recent years have proved that Eau de Javel bleaches the nuts better than sulphur fumes. In order to prepare Eau de Javel, 20 gm. of dry chloride of lime at 90° C are mixed with 600 gm. of water. Then 40 gm. of crystalline potassium carbonate are dissolved in 300 gm. of water and the two solutions are well mixed, and filtered after settling. The Eau de Javel is sprayed over the spread out nuts, which are afterwards washed very quickly in carbonated water, and finally, taken to the drier. The dry walnuts are kept in boxes or sacks in a cool place, and protected from drought or damp.

In order to prevent the origin of the nuts being wrongly stated, syndicates of growers have been formed in the Isère, especially in the arrondissement of Saint-Marcellin.

II. — The walnut-tree occupies an important place in French agriculture, a large number of nuts being exported, especially to the United States. From 1885-1916, the total walnut production of France varied from 210 000 to 1 590 000 quintals, being usually between 500 000 and 800 000. In 1916, the export of walnuts rose to 172 432 quintals, worth nearly 30 million francs, as against the total value of some 22 million francs for all the other exported dried or fresh fruits and fruit products.

Since 1885, walnut production in France has steadily decreased, falling to one half in 25 years.

As the walnut is a very important article of export, the author suggests that walnut-trees should be specially protected in France, and studies the following questions :— How can these trees be protected, and their cultivation improved ? What measures could be adopted by the State for safe-guarding the trees, increasing their returns, extending the area planted, and retaining the foreign market ?

PROTECTION OF WALNUT TREES. — This does not mean preventing the voluntary destruction of the trees, for since the value of the annual crop is practically equal to the sum which the wood would fetch, no owner of good walnut trees dreams of cutting them down. The State, however, might improve and facilitate the cultivation of the walnut.

The increase of the yield, the improvement of the varieties, the adoption of rapid methods of cultivating the soil of the plantations, the selection of suitable fertilisers, instruction in grafting, and the search for good stocks, are all matters requiring scientific study in order to effect any real improvement, but the research work can be carried out as well on the land as in the laboratory.

Little is yet known as to the conditions of climate and of soil moisture most adapted to the walnut, the stocks to be chosen for grafting, the method of transplanting, the spacing of trees when planted out, and the amount the trees should be pruned.

THE MAINTENANCE OF THE SOIL IN WALNUT PLANTATIONS. — A fairly large number of cultural operations is needed to keep the soil in a relatively friable condition and destroy the weeds.

In the regions of small holdings, which are the chief centres of walnut production, the labour crisis calls for an adaptation of motorculture, and the study of special tilling machines, for with an ordinary plough or tractor there would be a great risk of cutting the roots of the trees. The preparation of the soil for the crop (superficial cleaning), can be done by means of tractors. Further, it is necessary that the large amount of labour necessary for the short picking season, which is very difficult to procure, should be better organised and supervised.

COMBATING ANIMAL AND PLANT PARASITES. — Nearly every thing in this direction still remains to be done. Insects make the nuts " maggot ty ", fungi, of which the most dangerous would appear to be *Armillaria mellea*, attack the roots and the living portion of the trunks, or destroy the wood, so that they soon become hollow. Little is known of these parasites and still less of the way of combating them. When trees are removed that have died from the attacks of fungi, the soil in which they have been growing is never disinfected, and yet growers state that young trees planted to fill up gaps in the walnut woods rarely survive.

PREPARATION OF WALNUTS FOR SALE. WALNUT KERNELS AND OIL. — It is necessary to study the machines used for the different operations to which the nuts are subjected after being gathered : washing, sorting, sulphuring, drying. The apparatus devised for the treatment of colonial fruits might be adapted to breaking and shelling the walnuts. The manufacture of oil, and especially of oil that does not soon turn rancid, are subjects for careful study. The commercial side of the question (growers syndicates, the sale and transport of nuts) is also worthy of attention.

Perhaps wood industries could be started on the spot, so as to turn to good account the large quantities of walnut wood that is now actually lost, or used for fuel.

The author advises the formation of a special organisation for the study of the walnut-tree, the founding of a " Station for the study of the walnut tree ", equipped with chemical and pathological laboratories, an observation field, and an experiment field.

1124 - **The "Fuciletta" Cherry in Italy.** — PRIGANTI, G., in *L'Italia agricola*, Year 58, No. 8, pp 231-242. 1 plate. Piacenza, August 15, 1921.

The export season for fresh Italian fruit opens with the consignment of cherries. These are not only sent in their natural condition, but also after having been bleached with sulphur dioxide.

Bleached cherries are a special industry in Campania and the province of Bari (1).

It may be said, that each region of Italy has its special varieties of cherry ; some of these are of excellent quality, for instance " Imbriani ", which Messrs CIRIO have made well-known of recent years in Campania.

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(1) See *R.* Feb. 1921, No. 208. (*Ed.*)

The fruits of this variety, are firm, of average size, and have pink pulp and small stones; they are well adapted to bleaching.

The most common of the varieties grown in the Province of Bari is "Fuciletta". The tree is remarkable for its very vigorous growth, which it long retains, and its constant crop whenever it is able to root well, as it does in the district of Bari, where the soil consists of the "terra rossa" (red earth), and the calcareous subsoil is traversed by many cracks. The chief characters of this variety are as follows:

Branches strong, oblique, only growing horizontal in old trees.

Leaves elliptical, 6.5 cm., broad, and 18 cm. long (the petiole representing 5.5 cm.). Edges with small pointed teeth, the apical tooth being much the longest and sharpest. Vein distinct on lower surface. Blades glossy, deep green on upper surface, of a lighter shade on lower surface; smooth. Petiole slender, cylindrical, present on both sides; at the beginning of the blade are two elongated, deep-red glands. Petiole slightly grooved.

Flowers many in number, white, open the first fortnight in March.

Fruits subspherical, depressed on the upper portion, bright ruby red and glossy when quite ripe. Average diameter 2.7 cm.; average weight 9 gm.; borne on a peduncle 3.5 cm. long on an average. Stone small; pulp very fleshy and white. Taste sweet, slightly acidulate.

Ripening in May after the 10th of the month; exact date depends on the exposure and altitude.

1125 - **The Mango Tree in Costa Rica.** — *Boletin de la Cámara de Agricultura de Costa Rica*, No. 1, pp. 9-11. San José de Costa Rica, April 1921.

The mango-tree was imported into Brazil from India in the eighteenth century, and spread from the former country over all tropical America. It grows very well at Costa Rica; sometimes attaining the height of 20 m., though usually it is from 8 to 10 m. high. The tree requires no special attention, and continues to bear fruit regularly for many years. It seems subject to no disease.

The mango adapts itself to the most different climates, but a really dry season is necessary for the ripening of its fruit. For this reason, the best Costa-Rican fruit is produced in the Departments of Alajuela, Guanacaste, and Puntarenas, where the altitude is always below 1000 metres.

The tree is grown from seed, the only selection practised being the choice of the seed from the finest fruits.

Shield-grafting is common, but does not give entirely satisfactory results; it would be better to replace it by in-arching combined with the progressive removal of the portion of the scion that remains below the graft-callus.

Good crops of excellent fruit are produced, especially in the western areas of the country.

1126 - **The "Marañón" (*Spondias dulcis*) in Costa Rica.** — *Boletin de la Cámara de Agricultura de Costa Rica*, No. 1, pp. 14-16. San José de Costa Rica, April 1921.

The *marañon* (*Spondias dulcis*) is one of the most highly-prized and valuable fruit-trees of Costa Rica. It grows to the height of 4 metres, and is unexacting and very hardy, doing well even on stony slopes, and not harmed by the presence of weeds or the grazing and treading of animals that crop the grass beneath the shadow of its leaves. The fruit is however, more plentiful when the orchard is carefully tended, that is to say if it is ploughed 2 or 3 times a year, lime and ashes being applied to the soil, the trunks limewashed, and the ground irrigated several times, if possible.

The tree is raised from seed. The seeds are sown 4 metres apart in a square; should the quincunx arrangement be adopted, 1 hectare can bear 700 trees; fruiting begins in the fourth year.

Old trees cut down to a little above the root-collar throw up fresh shoots, and produce a good crop for some years. The fruit is a drupe of lemon-yellow colour and may attain the size of a lemon. Part of the crop is exported, the rest is either consumed locally or used for making a delicious liqueur. The seeds are used in the manufacture of preserves.

1127 – **New Vine Stocks in Italy.** — ZANOTTI, L., in the *Giornale vinicolo italiano*, Year 47, No. 33, pp. 323-325, 2 figs. Casale Monferrato, August 14, 1921.

Among the vine-stocks created of recent years, the author mentions, as having apparently given good results, No. 5, BB Kober (Berlandieri × Riparia), and the two hybrids obtained by M. PIROVANO, of Vaprio d'Adda (Province of Milan), viz. 2-59 P., and 1-37 P.

The first is the best of the Austrian vine-stocks; it was selected by Prof. KOBER, Chief Inspector at the Ministry of Agriculture at Vienna. It has been widely used in the reconstruction of vineyards in Austria, where it is as popular with the vine-growers as Telechi No. 8 B. It does best on very calcareous (7 %), and on damp soils, but has also grown well for 20 years on clays. It has much grafting affinity with a large number of vines, causing them to produce an earlier and larger crop.

The Pirovano hybrids described by the author are distinguished by their vigour, and their resistance to lime, drought, phylloxera and fungoid diseases.

1128 – **Notes on the Exploitation of the Forests of the Equatorial Regions.** — TOUTÉE, in the *Comptes rendus de l'Académie d'Agriculture de France* Vol. VII. No. 24 pp. 545-554. Paris, June 22, 1921.

The author gives practical data showing that though a given region may be rich in forests, it does not always follows that the exploitation well be as remunerative as might be expected. This is generally the case when the forests are difficult of access, and without roads, and especially in those of the Equatorial regions where the many different species growing in a confused mass (as many as 150 may be counted on an average in an ordinary felling zone) differ greatly in quality and value. In such places, felling, classification and removal are very costly, even in forests traversed by a railway, since the belt to be worked may be as much as 200 m. in width on either side of the line. The freightage, increased by the cost of conveying the timber from the forest to the train, and thence to the port, becomes prohibitive.

The author draws attention to the clearing methods adopted by the natives, who after felling the trees on a given area, pile up all the wood thus obtained and allow it to dry, subsequently setting fire to it, in order to burn the trees which they are unable to cut down. All the clearing so made they cultivate, until the ground is entirely exhausted, when they and the whole village migrate to another freshly cleared space. This exhausted ground become over-run by the "parasolier" (umbrella-tree) a tree which prevents the growth of more valuable species. Its wood is so light as to be useless for ordinary purposes, but as it consists almost entirely of pure cellulose it is very suitable for paper-making The pulp could be prepared on the spot, for in the centre of the area covered by these trees, there are large streams with water-falls providing many thousands of H.P. together with all the water necessary for the treatment of the fibre. Thus everything required for starting a paper factory is at hand.

A second species of tree mentioned by the author is the mangrove (*Rhizophora racemosa = R. Mangle*). This is exceedingly easy to fell and remove, for it occupies areas which are much more accessible than those covered by the "parasolier"; they are of vast extent, and form the deltas of rivers flowing into the Atlantic.

Excellent railroad sleepers could be made from mangrove wood, for its weight would give solidity to the line. It offers great resistance to flexion, being twice as rigid as oak, and it is said to be almost, if not entirely, rot-resistant. This wood is also very suitable for making casks.

1129 - **Preparation and Use of Danish Timber.** — OPPERMANN, A. Tilvirkning og Anvendelse of Dansk Gaontree in *Det Forstlige Forsøgsvaesen i Danmark* Vol I, Pt. 2, pp 135-211, figs. 8, Vol. II, Pt 3, pp 331-361, figs 7 Vol V, Pt 4 pp 301-337, figs. 2. Copenhagen, 1906, 1911, 1920.

Forestry tries to ascertain the amount and quality of the yield obtainable with a view to finding out the most practical mode of working. The tests undertaken to this end are apart from a rough estimate, maintly based on measurements of the trees and technological experiments, although certain authors from a more practical, mercantile point of view have made investigations into the timber products. Technological and analytical research give information as to the mechanical, physical, and chemical qualities of the wood. In the terminology of foresters the idea of "quality" was once nearly synonymous with strength and durability as far as timber was concerned and heating power in the case of fire-wood. As all these qualities depend to some extent on the specific gravity of dry wood, the next step was to consider this — or rather the ligneous substance contained in a piece of wood — the standard of quality (ROBERT HARTIG). In more recent times the tendency has been to refer to the anatomical structure; a comparison between spring-wood and summer-wood, the proportion of cavity to thickness of fibre; that is to say the magnifying glass and the microscope take the place of the scale and the xylometer.

Increment measurements together with an estimate of the age of the trees, show the amount of production of wood as well as dimensions, and trees are classified according to size, shape, and structure, the line often being drawn mainly with a view to the requirements of practical working. While the trees are in growth, it is generally the surface only that the forester is able to examine and when they have been felled and worked, it is but a few cuts and lengths which can be examined. Experience and practice, however, together with knowledge of the structure of the wood, enable the forester to judge of the inner qualities from the outer shape and configuration, and in this respect he is assisted by his customers, who at least emphasize flaws and defects, while their approval results in greater demand and better prices.

The manufacturer, to whom wood is his raw material, must above all make sure to get the most out of it in the form of manufactured articles; in his estimation technical qualities will usually be of only secondary importance. The strict classification into specifie groups according to dimensions of the wood and the strong prominence given to the mere bulk of each class offered for sale have tempted the forester to lay the chief stress on formal compliance with regulations for classification, and not on the more essential consideration of what is in demand. It is the consumption now and in the future that is to direct felling, cutting and classification of the trees as well as cultivation and tending of woods; the prices made will show the character of the consumption, but practical forestry cannot be guided by it.

The experiments and tests discussed in the papers above quoted, are to show how dimensions, shape and structure — or possibly defects in structure — affect the amount and quality of the yield. To this end the raw material — trunks and piled timber — is examined much more closely than hitherto, and the yield obtained is divided into its various categories In practical forestry as also in the timber trade, stands and even regular forests often ought to be classified according to what characterizes the wood for some large area, indicating its particular use, the present state of the market always being taken into consideration.

In the long run it will be best for all parties concerned that each seller seeks a market for his goods where their good qualities are duly appreciated and the inferior ones tolerated; on the other hand, saw-mill and woodworking factories ought to be set up in districts that can deliver a constant supply of suitable raw materials.

The trunks examined are not classified according to length and diameter only. As the size of the knots, the decrease of diameter and several other characters change from root to top, a classification according to sections of height is also often made so as to distinguish the butt from a series of consecutive sections each at a certain distance from the ground. In this way we learn to understand how distance between the plants as well as cutting and pruning affect the amount and quality of the yield. It is obvious that these tests may to some extent be of assistance to the owners of saw-mills and similar factories, especially through particulars as to quantity of saw-dust, chips, etc. But this is not the principal object but rather the construction of a more solid basis for the production of timber, ranging from the very start of the work — selection of species and choice of seed — to the final preparation in the forest. Of the many experiments and tests the following may be mentioned (1).

1) *Staves made of beech-wood.* — The yield increases in proportion to diameter up to 10 Danish inches (1 Dan. inch. = 1.0297 Eng. inches.; 1 Dan. foot = 1,07 Eng. feet), after that decreases, but reaches a new maximum at 16 D. in. Even wood of 5-6 D. in. diameter may yield a considerable supply of staves, but these are always narrow (2 $^1/_4$ D. in.). At only 8 — 10 D. in. nearly the same amount of first class staves is obtained as from the class of 14 — 16 in. Classifications according to shape and purity of the three qualities *a*, *b*, and *c*, prove that the amount of interior staves increases from *a* to *c*, this last quality giving 30 per cent. less than of good wide staves. How the amount of stave-wood decreases in proportion to the distance from the ground may be learned from a special investigation on height sections in beech stands. As to saw dust, varying from 10 to 11 %, a good quality of wood gives more than an inferior kind, and thin wood more than thick.

2) *Shovel-handles made of beech-wood planks.* — Two trunks, 12 D. feet long, were divided into 3 sections, each of which gave 9 planks. From root to top the number of handles decreased as follows: 51, 43, 43 per cent., while for the inferior turner's wood 4, 8, and 4 per cent. was the result. The total amount of partly manufactured articles was 55, 51 and 47 per cent. Plank No 5 being next to the pith, 1 and 9 to the outer parts, the yield would be as follows:

		For planks				
		Nos 5	Nos 4 + 6	Nos 3 + 7	Nos 2 + 8	Nos 1 + 9
	%	40	41	54	41	0
Turner's wood	%	3	6	4	7	22
In all	%	43	47	58	48	22

The maximum of yield is thus far from the pith, planks 3 + 7, although narrow and sloping at the sides, but knotless and of regular structure.

3) *Bottoms for shoes made of beech-wood butts.* — 18 trunks, diameter 24-40 cm., were divided into 3 sections according to diameter, and each of these into 3 classes according to quality. The number of bottoms is 8-12 per cent., leaving some inferior timber. The loss on the small butts consists mainly in bottoms for small foot-wear. The bigger the butt, the greater amount of large bottoms for grown-up people.

4) *Spokes made of oak butts* — 16 trunks, averaging 18 D. feet in length, were cut into spokes, 2 D. feet long, after having been divided into 3 sections: root trundle, trundles nos. 2-5 and trundles nos. 6 and upwards. In each section trundles of more and less than 25 cm. were kept apart, and the two upper ones were divided into 3 qualities: *a*, *b*, and *c*. The yield was as follows:

(1) Cf. A. OPPERMANN. Trae og andre Skovprodukter, chap XVI, København, 1911, 16. (*Ed.*)

	Spokes, per cent., in the trundles		Spokes, per cent., quality	
	under 25 cm.	over 25 cm.	firsts	seconds
I. Root Trundle	34	48	78	22
II. Trundles 1-5 . . . . . . a)	44	50	63	37
b)	40	47		
c)	0	37		
III. Trundles 6 & upwards. a)	40	40	42	58
b)	38	44		
c)	29	37		

The top section gave a number of seconds, and they were mostly small. The proportion between firsts and seconds does not vary much in the same class divided according to width and quality; the loss in section III is due to the fact that it contains a proportionately large amount of inferior wood. The knotless part of the heart-wood of the trunk forms a shell, the thickness of which decreases greatly towards the top; the knotty part has the shape of an inverted cone.

5. *Handles for implements, made of ash butts.* — 62 small butts 86-180 cm. long, were sorted into 3 classes according to diameter, and these again according to quality into classes *a*, *b*, and *c*. The butts were cut into square poles, 1 5/8 × 1 5/8 D. in., to be turned into handles for implements. The yield in metres per m³ was as follows:

Yield of poles, m. per m³	Diameter and quality of the butt							
	under 30 cm.			30-35 cm.			over 35 cm.	
	a	*b*	*c*	*a*	*b*	*c*	*a*	*b*
Firsts	192	77	32	202	109	106	226	216
Seconds	36	133	79	31	83	69	19	51
In all . . .	228	210	111	233	192	175	245	216

It is evident that the quality of the butts is fully as important as the dimensions; first class butts of less than 30 cm. yield better results than seconds of more than 35 cm., and first class butts yield a much larger amount of first class poles, but fewer second class than butts of an inferior quality.

6) *Boards made of spruce butts.* — 80 butts, 12 D. ft. long, 12-26 cm. in diameter, were cut into boards, after having been divided into 7 classes according to diameter. The yield of unassorted boards increased but little in proportion to the diameter of the butts, but the thick butts yielded fewer boards of an inferior quality and many more good squar-

ed ones. The butts of each class according to diameter were subdivided into classes *a* and *b* according to quality, with the following average results:

a) Squared boards 49.0 per cent., inferior boards 10.4 per cent., in all 59.4 per cent.
b) » » 44.6 » » » » 10.4 » » » » 55.0 » »

Of the entire lot of butts the results were: 54.2 per cent. boards, 31.1 per cent. waste products, 14.7 per cent. saw-dust.

7) *Height sections of spruce trunks.* — 15 spruce trunks 48 D. feet long were divided into 4 height sections so as to yield 15 butts of each. The amount of unassorted boards decreases but little in proportion to height, but the amount of squared boards from the 2nd section was twice that of the 4th. By sorting the squared boards according to quality, the inferior goods from the four sections were found in the following proportion: 35, 82, 78, 87 per cent. The value of the boards produced shows the following distribution according to the four sections: 36.1, 28.8, 22.2, 12.9 per cent.

8) *Straight and crooked butts from spruce.* — In square plantations the trees that attain dimensions for timber will often have a curve at the bottom: the curvature observed being 6.5 cm. The aggregate amount of boards is not reduced by this defect, but in the squared boards the proportion between crooked and straight butts is 3 : 4, and of these there were 73 and 10 per cent. respectively of an inferior quality. The loss sustained by this form of cultivation may thus be very considerable.

9) *Wood-wool from spruce.* — A quantity of barked spruce was sorted according to dimensions yielding the following amount of wood-wool:

Diameter . . . . . cm.	6.5 to 8.5	8.5 to 10.5	10.5 to 12.5	12.5 to 14.5	14.5 to 16.5	16.5 to 18.5	18.5 to 20.5	20.5 to 22.5
Wood-wool. kg. per m.^{3}	356	393	411	426	423	413	423	405

Cheap and thin wood accordingly yields the same amount as the thick, which may thus more profitably be used for boards and similar material. The Danish export of eggs demands a large consumption of wood-wool, and thus earlier thinnings may be profitably utilized.

10) *Cellulose from spruce.* — A parcel of spruce was sorted according to dimensions yielding the following quantities of air-dried cellulose:

	Wood from stem			Wood from top	
Diameter . . . . cm.	10–15	15–20	20–25	10–15	15–25
Cellulose . . . . . kg per m.^{3}	170.6	177.5	185.6	163.2	170.5

As with the previous experiment the advantage of using the thin, cheap wood is evident.

A comparison between points nos. 1-5 on the one hand and nos. 6 10 on the other shows that a rational sorting of wood of broad-leaved trees is far more complex than the sorting of spruce.

11) *Production of planed, tongued and grooved boards.* — By the process of planing on all four sides, spruce boards, 1 1/4 D. in. thick, lost 22-23 per cent. in weight and bulk being more than is generally supposed.

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12) *Thickness of blade and amount of saw-dust.* — By cutting laths from spruce butts, using three different circular saws, the following amount of saw-dust was obtained :

Thickness of blade . . . . mm.	3.6	2.7	2.0
Amount of saw-dust . . . . %	22.3	18.4	12.3

Experiments like those mentioned above are quite simple; they are neither applied natural science nor applied economics. But they demand considerable circumspection, perseverance and exactness on the part of the person in charge of the work; when this work is to be kept within reasonable bounds, it must be planned in such a way that the experiment may settle the question asked without demanding more attention than absolutely necessary; and in formulating the problem to be solved in each case some knowledge as to how timber is to be worked and utilized, is requisite together with an understanding of the growth of trees and how they should be classified.

1130 - **Experimental Researches on the Electrical Treatment of Wood in Italy.** — PETRI, L., Extract from the *Annali del R. Istituto superiore forestale nazionale*, Vol. VII, pp. 3-118, 28 figs., 1 plate. Florence, 1921.

The author gives an exhaustive summary of all that is known respecting electro-capillary phenomena, and describes the experimental attempts hitherto made to dry and preserve wood by electrical treatment. He then describes his own experiments (so far limited to laboratory work), made chiefly for the purposes of determining :— 1) How far electro-osmosis, can be used industrially to impregnate different kinds of wood with antiseptic fluids, and what are the advantages and disadvantages of this process; 2) the practical value that can be attributed in electric impregnation to the displacement which takes place, within the ligneous tissue, of the ions of the solution when the electric current is passed through it ; 3) whether it is possible to fix the preservative substance in the wood by means of any reactions taking place between the products of electrolysis and the chemical constituents of the cell membrane or cell contents.

The application of electricity to the preservation of wood, by inducing the rapid penetration of antiseptic substances into the tissues, or to hasten its drying, has not yet been attempted industrially, although different investigators have repeatedly tried to discover practical methods for carrying it out.

It is a question whether this neglect of the subject is due merely to the inconstant or negative results obtained, and to the unpractical nature of the schemes suggested or whether there are economic and technical difficulties that prevent the industrial adoption of the electrical process.

In this article the subject is examined objectively, and, by giving the results of the first series of experimental researches, an attempt is made to throw some light on the principal questions that arise in studying the problem.

In the first place, it must be recognised that experiments on the impregnation of wood by means of solutions of electrolytes and the passage of the electric current, are justified by two classes of phenomena, viz., electro-osmosis, and the movement of the ions during the passage of the current

As regards the first of these phenomena, the author's experiments have proved that when wood is subjected to a continuous electric current, the realisation of the conditions which favour the passage of the maximum amount of liquid into the wood by electro-osmosis is of importance only when it is desired to obtain an appreciable exosmosis of wood sap, since when antiseptic substances are injected, they penetrate equally well into the cells, even if electro-osmotic transport of the liquid is at its lowest.

The amount of liquid carried through the wood in a unit of time varies according to the species under treatment, the concentration and conductivity of the solution used, and the current tension.

The electric impregnation of wood is easily attained with liquids having a relatively high dielectric constant, that is to say, with substances which show considerable dissociation of the molecules on going into solution. Nevertheless, provided the treatment is much prolonged, it is also possible to carry out the impregnation with substances that are bad conductors of electricity, but this is not satisfactory from the economic standpoint.

As a rule alternating current is preferable to continuous, because it enables the resistance of the wood to be overcome more quickly and induction resistances can be introduced into the circuit instead of chemical resistances. There are however some cases in which a continuous current gives better impregnation results, e. g., when corrosive sublimate is the substance to be used.

Complete impregnation of wood by the electric process can be obtained if the ligneous tissue is *still fresh*, that is to say, if the tree has been lately felled, and the wood cells are still well-supplied with water (40-50 %).

Dry wood that has been swollen by immersion in water, does not regain the electrical conductivity of green wood and is difficult to impregnate. The rapidity with which the same salt solution penetrates into wood when transported by the electric current is much greater than when simple imbibition takes place.

It is not possible to dry wood by the electric process in the same manner as by the natural process. The slowness of the natural process is due to the predominance of oxidation, whereas in the artificial treatment, the indirect action of the current causes reduction and hydrolytic phenomena to have the ascendancy.

It is thus possible by using a continuous current to impregnate wood with a weak solution of sulphate, or even very dilute sulphuric acid, to obtain the hydrolysis of the starch and most-easily hydrolysable compounds while exosmosis of all the other solutions contained in the ligneous tissue is taking place towards the cathode. This treatment may well be termed an *electric leaching* of the wood, and can be compared, as regards some of its effects, with *steaming*.

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With electric impregnation unlike ordinary processes, the toxic substance is fixed in the tissues, so that the preservative action of the former cannot be lessened by the action of water. This, however, only applies to certain metallic salts.

Wood injected electrically with zinc chloride, if subsequently immersed for a long time in water, does not lose any of the immunity to fungus attacks conferred by this salt, and is free from the increased hygroscopicity which is such a serious trouble when ordinary methods are adopted.

As regards the physical properties of wood, electric treatment causes a diminution in the changes of volume caused by variations in humidity, but for this result to be attained the current density must be high, 2 ampères per square decimetre. Under such conditions there is also a perceptible decrease in the resistance to flexion and shock. With less current density (0.10-0.20 ampères per square decimetre), the injurious effect is almost negligible.

Since wood that has undergone electric treatment loses a little of its hygroscopicity, it dries more quickly than untreated wood, but the difference is so slight that it is not worth while applying electricity in order to hasten drying Drying can however be effected by using a 150-volt current, but this frequently lessens the mechanical strength of wood

Experiments have shown that sleepers or beams for electric treatment should be placed on a layer of powdered gas carbon (lower electrode) put at the bottom of a wide but shallow basin containing the solution to be injected . Another layer of gas carbon is placed upon the wood (upper electrode), and well pressed down.

The two electrodes are connected by carbon rods to the cables of the dynamo. The water in the basin is raised continually by a pump and allowed to fall in showers upon the upper electrode.

One difficulty arising during the process is due to the different conductivity of each piece of wood. Some pieces allow an excessive amount of the current to pass, whereas others show great resistance. This trouble can, however, be overcome by gradually substituting untreated beams for impregnated ones, or by making two layers of beams placed at right angles to one another.

In order not to injure the physical properties of the wood by causing successive processes of hydrolysis, the limit of 0.80 amperes per square decimetre ought not to be exceeded.

As regards the practical application of the electrical treatment of wood, it should be regarded as suitable only for the impregnation or leaching of pieces with rectangular section, such as railway-sleepers, beams, joists, and paving-blocks. The preservative substances likely to give good results are zinc chloride, bichloride of mercury, and perhaps sulphate of copper, especially with beech-wood, if a low-frequency alternating current of not more than 0.5 ampères per square decimetre is used.

It would be premature to draw from these laboratory experiments any definite conclusions regarding the possible practical use that may be made of the facts just stated.

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Further experiments carried out on a larger scale should be undertaken to determine many points that the author has purposely neglected, such as for instance the amount of electric energy necessary for the impregnation of a cubic metre of wood with electrolyte solutions found most suitable for the purpose.

The work so far done inspires the author with the conviction that the application of the electric current to the preservation of wood will give good results (although only under given conditions), contrary to the pessimistic opinions expressed by certain other investigators.

LIVESTOCK. AND BREEDING

1131 - **Study of the Trypanosomiasis of Stock in Venezuela.** — TEJERA, E, in the *Bulletin de la Société de Pathologie Exotique,* Vol. XIII, No. 4 (meeting on April 4, 1920), pp 207-305. Paris, 1920

A) EQUINE TRYPANOSOMIASIS. — This disease is met with almost throughout Venezuela. It usually attacks horses, but is not infrequently found affecting mules and donkeys. It is an epizootic disease occurring under two rather different forms, which were long believed to be caused by separate pathogenetic agents, whereas they are now known to be merely two clinical types of the same disease. Both are caused by a trypanosome of the *evansi* species; it was discovered by RANGEL (1) and described by MESNIL under the name of *Trypanosoma venezuelense.* A detailed account is given of both forms, the chief characters of which are as follows: —

(a) *" Peste boba ", " hermosura ", or " tristeza "* — Characterised by loss of flesh accompanied by oedema in certain regions of the body; and depression. Breeders state that the first symptom is the dullness of the coat, which latter loses its gloss, becomes shaggy and dry, comes out easily and as the attack progresses, bald patches appear. Until this moment, the animals appear in their usual health, and it is very difficult to identify the cases: if their temperature is taken it is found to be high.

Soon after the first symptoms appear, the animal becomes listless and goes off its feed; this condition lasts only a short time, however, sometimes only 1 on 2 days. Afterwards the patient recovers its spirits and appetite, and seems quite well, but a few hours of work render it depressed and disinclined for exertion. The trypanosomiasis continues to develop, oedema of the face is noticeable, the eyelids swell so as more or less to conceal the eye-ball. Details respecting the appearance of the oedema are given. The animal rapidly becomes anaemic. The nasal and buccal mucous membranes are white and bloodless. Often signs of conjunctivitis accompanied by watering of the eyes are seen. A yellowish matter exudes from the nostrils. The temperature rises from time to time. During the last period, the fever is generally continuous and is accompanied by dyspnoea and tachycardia. The disease lasts 1 or 2 months, and over 80 % of the infected animals die.

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(1) R. RANGEL, *Laboratorio del Hospital Vargas* (Boletín), No. 2, 1906, p. 11. (*Ed.*)

b) "*Desrengadera*". — Characterised by progressive loss of flesh and very pronounced anaemia. The animal becomes easily tired, and shows symptoms of tachycardia accompained by dyspnoea.

Very soon after these symptoms manifest themselves, disturbances of the nervous system are observed, viz., inco-ordination of movements, symmetrical paresia of the hind limbs, rarely complete paralysis. At first, the animal only stumbles occasionally, later it moves its hind legs with difficulty, dragging the tips of its hoofs along, and walks with stiff legs held very far apart. Every moment its difficulty in balancing itself increases, and often the animal has to lean against something, in order to keep on its legs. Nevertheless, it is a curious fact that at this stage of the disease it can run fairly well. Gradually, the symptoms of paresia increase, until the patient can no longer stand. Finally, it falls to the ground, but if given nourishment, it may live for some days in this condition. The mortality in cases of "*desrengadera*" is about 100 %. The animals that regain their health are few in number, and as the paresia of the hind-quarters persists, they are useless. In acute forms, the animal dies almost instantly before the first symptoms of the disease have fairly developed.

From the clinical standpoint, Venezuelan trypanosomiasis much resembles, in its complex of symptoms, Argentine trypanosomiasis (*mal de caderas*), except that in the former, haemoglobinuria which frequently occurs in the latter, is never present. Nevertheless, it is impossible to confuse the pathogenetic agents, for the two trypanosomes differ morphologically. *Trypanosoma venezuelense* appears to be far more virulent. The disease produced by *Trypanosoma equinum* generally lasts from 2 to 5 months, whereas the duration of Venezuelan trypanosomiasis, is only from a fortnight to 2 months. The latter disease usually appears at the beginning and end of the rainy season, most of the cases occurring in March and April. The carrier of this form is so far unknown.

In cases of natural infection *Trypanosoma venezuelense* has proved very virulent in horses, many thousands having died from the disease. It is of frequent occurrence among horses kept by breeders in "corrals", but is very rare among wild horses. Mules and donkeys are also subject to "*desrengadera*", but to a far less extent. Specimens of the capibara (*Hydrochoerus capibara*), suffering from paresia of the hindquarters, and infested with *Trypanosoma venezuelense* are frequently met with on the plains of Venezuela.

R. RANGEL has found dogs and monkeys attacked by the same trypanosome. Dr. A. I. FERNANDEZ says that he has discovered, in the blood of many monkeys, trypanosomes morphologically the same as *Tryp. venezuelense.*

In order to study the virulence of the *T. venezuelense*, the author inoculated some guinea-pigs, rats, mice, a horse, two monkeys, a cat, and a heifer. All the animals, except the heifer died after the disease had run a shorter or longer course. The heifer was inoculated with 1 cc. of guinea-pig blood; on the 7 th day, the animal had 40° C of fever, and this temperature did not change until the 10th day after inoculation. Then the trypanosomes in the peripheral circulatory system became much reduced in numbers, and disappeared entirely 4 days later. The heifer was infectious for 5 months after inoculation, but subsequently showed no signs of disease.

B) CATTLE TRYPANOSOMIASIS. — All the infected animals examined by the author were extremely emaciated and their skin showed may alopecic patches. The colourless mucous membranes pointed to a very advanced stage of anaemia. At the level of the neck, an especially hard swelling was to be seen This swelling, which sometimes is located in the dewlap, goes by the name of " papera " (goitre), among the breeders. The sick animals stand apart from the rest and are depressed, but their appetite is about normal.

The pathogenic agent, which had no effect when inoculated into adult guinea-pigs and a cat, seems from its characters, as described by LEGER and VIENNE, to be identical with *Trypanosoma guayanense*, which attacks cattle in French Guiana. This supposition is strengthened, by the fact that the latter does not attack dogs or guinea-pigs.

The author is inclined to believe, with F. MESNIL (1), that *Tryp. guayanense* is a variety of *Trip. cazalboui*, if it is not actually the same micro-organism for, as is well-known, these two trypanosomes are alike in not attacking rats, mice, guinea-pigs, dogs, cats, and monkeys, and in infecting only ruminants and equidae.

The cattle disease having the characters described by LEGER and VIENNE, and which was observed by the author in Venezuela, appears not to have existed long in the country, so that the author suggests that perhaps the zebu, an animal introduced into Venezuela some years ago, may have brought with it the form of trypanosomiasis known as " souma ", which is produced by *Tryp. cazalboui*.

1132 – **Current Ideas Respecting the Licking Habit in Cattle and Its Causes. Results of Practical Experiments with Drugs in Prussia.** — ZUNTZ, N., in the *Mitteilungen des Vereins zur Förderung der Moorkultur im Deutschen Reiche*, Year XXXVII, pp. 437-440 Summarised in *Biedermann's Zentralblatt*, Year I, Part 1, pp. 33-34. Leipzig, 1921 (2).

The analogy between the symptoms of the licking disease and those induced by depriving young growing animals of certain constituents of protein, such as tyrosin or tryptophane is, according to the author, so striking, that we are compelled to suppose that the habit of excessive licking in cattle is due to the absence of one or more of the substances necessary for the development of the organism. Further, the grazing experiments made by the author, the success of applying a dressing of sodium nitrate to the pastures, and the fact that the after math suited the animals better than the first cutting of hay, all suggested that the trouble was due to a deficiency of protein.

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(1) MESNIL, F, Analyse du travail de MM. LEGER et VIENNE, in the *Bulletin de l'Institute Pasteur*, Vol. XIV, 1919, p. 076. (*Ed.*)

(2) See *R.* Aug. 1914, No 708 (*Ed.*)

As is well-known, only a portion of the plant protein consumed enters into the formation of animal protein.

The richer the forage in protein, the easier becomes the elimination of the constituents which are not used in metabolism. Further, in many cases, the real remedy for the licking disease may consist, on the one hand, of increasing the absolute amount of protein, and on the other, of giving protein of a different composition by altering the botanical constituents of the forage, or the fertiliser, or using forage of a different quality, viz., at different stages of growth. The drying of the forage may also have some effect, seeing that under natural conditions certain components are washed out by the rain, and that the action of the sun produces chemical changes affecting some important substances present in fresh grass.

The author, after a consideration of all the data referring to the licking disease, and the conclusions that may be drawn from them, recommends the following prophylactic measures:—

1) Care should be taken that sodium should not be lacking in the forage. The rest of the mineral constituents should form a basic mixture containing 600 to 750 mgm. of alkali equivalents.

2) The protein content of the ration ought to be increased by the addition of concentrates rich in protein (linseed cake, palm-oil cake) suitable for ruminants.

3) Hay must be made of the youngest grass possible; this has recently been advised by NEUBAUER, as the best means of remedying the lack of protein in forage intended for growing stock.

4) In conclusion, the author lays great stress on the necessity of further experiment to determine whether the good effect of sodium nitrate observed by him is to be attributed to the sodium, or the nitrogen. In order to do this, one plot must be manured either with sodium chloride, or with sodium sulphate, at the rate of 780 to 1170 kg. per hectare, whilst another plot is manured with ammoniacal salts. During the execution of his experiments, the author still believed in the efficacy of the sodium in the sodium nitrate, but he is now inclined to ascribe the favourable effect to the nitrogen content of the forage.

The author considers that ordinary drying causes the loss of certain indispensable substances; the truth of this opinion should be tested by comparing the products of the usual drying methods and those obtained by ensilage, or a modern drying process entailing the minimum loss of nutrient substances.

1133 - **Experiments in the Treatment of "Debab"** (1). — SERGENT, EDM, SERGENT, ÉT and FOLEY, H., in the *Annales de l'Institut Pasteur*, Vol. XXXV, No 3, pp. 204-211. Paris, 1921.

The authors tried the following remedies for the treatment of "debab" (trypanosomiasis of dromedaries) at the Pasteur Institute of Algeria:—

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(1) See *R* Nov-Dec 1920, No 1130 (*Ed.*)

(1) 15 gm. afridol Cl. (o-dichloro-benzidine + H. acid) injected in 5 doses in 4 months; (2) trypano-blue in 3 injections of 4 gm. at an interval of 2 days; (3) emetic and atoxyl for 3 weeks, in intravenous injections of 2 gm. of emetic each week; 3 days later, a subcutaneous injection of 3 gm. of atoxyl; (4) a 0.5 % solution of emetic in tepid distilled water injected into the jugular vein.

In the doses used, afridol Cl. cured the animal 1 time out of 2; the amount of trypano-blue was insufficient; the emetic-atoxyl combination proved active; indeed emetic which has the advantages of being cheap and easily used for intravenous injections into camels, is capable of rendering signal service in the treatment of debab; if given in doses that are non-toxic to the dromedary, it however sometimes fails to act upon the trypanosome. It is thus necessary in such cases to try the effect of adding some other drug to the emetic. Quantities above 1.50 gm. are capable of killing a dromedary weighing 300 kg., but 1.50 gm. and less are well tolerated; 0.50 gm. is not sufficient; therefore the best amount is 1. gm.

1134 - **Critical Study of *Davainea* spp., Fowl Parasites in the District of Granada, Spain.** — RODRIGUEZ LOPEZ NEYRA C. (Laboratorio de zoologia de la Facultad de Farmacia en Granada), in the *Revista de la Real Academia de Ciencias exactas fisicas y naturales de Madrid*, Vol. XVIII, Nos. 7, 8 and 9, pp. 322-349, 3 figs., 3 pl., Bibliography of 26 works. Madrid, Jan. Feb. Mar., 1921.

The author gives the synonymy, morphological characters, life history, list of animal hosts, geographical distribution, and pathogenic action of the following species of intestinal worms found in fowls in the district of Granada: *Davainea tetragona, D. certicillus, D. proglottina*, and *D. enchinobothrida*.

1135 - **The Chemical Composition and Forage Value of the Straw of Different Varieties of Wheat Grown under the Same Conditions, in Italy.** — ALBERTONI F. and ROSINELLI, G. (Laboratorio di Chimica agraria della R. Università di Bologna). in *Le Stazioni sperimentali italiane*, Vol. LIV, Parts 4-6. pp. 129-144. Bibliography of 6 works. Modena, 1921.

The authors used the progeny obtained from selection experiments directed by Prof. TODARO, in order to answer the following questions.

1) Whether there is any chemical difference in the fully ripe straw of different varieties of wheat that have been grown under similar conditions. 3) The possible correlation between the composition and characters of the variety. 3) The forage value of straws thus grown.

1) *Chemical Composition.* — The straws investigated belonged to pure lines; they had grown in the same soil in a good year (1913-1914) with sufficient rainfall, and had not suffered from rust or lodging. The straw was cut at one third of its height. The analytical results are compared with the data furnished by other authors respecting the composition of wheats cultivated in higher latitudes.

This comparison shows that the soft wheats of the Province of Bologna are richer in ash, and hence poorer in organic matter; they contain more crude protein and are less lignified.

There was little difference in the amount of ash in the various Bolognese wheats (7.2 to 7.5 % of dry matter at 105° C except in the case of 2 families, when it was below 7 %), and also in the fats (from 0.9 to 1.75 % of crude fat, usually about 1 %). The investigation was thus confined to determining the amount of crude protein, cellulose, and phosphoric acid. The 13 families examined can be divided into the following groups :

(*a*) Straw containing over 3 4 % crude protein, less than 43 % cellulose, and 0.3 % phosphoric acid. Varieties :— Cimone, Normale, Rieti 1, Rieti 11, Gentil Rosso fam. 43, and Dur de Portonovo

(*b*) Straw containing over 3 % crude protein, less than 45 % cellulose, and. 25 % phosphoric acid. Varieties :— Cologna fam. 12, Nasolino, Bordelais, and Poulard d'Australie.

(*c*) Straw poorer than the preceding varieties :— Awnless Gentil Rosso, Inallettabile, and Turgido nero (Pétanielle noire).

2) *Correlation Between Chemical Composition and Variety.* — This grouping shows that the straw of different varieties of wheat grown un-

Digestible Nutrient Substances in Wheat Straws, in % of Material Dried at 105° *C.*

Varieties	Crude Protein	Crude fats	Nitrogen free extracts	Celulose	Digestible albumen	For 1 kg. dry matter calories equivalent to physiological nutritive effect (1)	to the assimilable matter (2)
Cimone	0.22	0.34	16.39	21.50	—	1397	327
Normale	0.27	0.46	16.37	20.75	—	1382	335
Cologna fam. 12	0.17	0.54	15.03	21.75	—	1378	303
Rieti fam. 1	0.22	0.29	17.37	20.16	—	1382	351
» fam. 11	0.21	0.34	16.82	21.00	—	1396	337
Masolino	0.14	0.49	15.97	22.26	—	1420	320
Gentil Rosso fam. 58 . . .	0.17	0.44	16.13	21.79	0.05	1406	275
Gentil Rosso fam. 48 . . .	0.20	0.31	17.31	20.39	—	1389	336
Rouge de Bordeaux	0.22	0.29	16.06	22.23	—	1413	301
Inallettabile fam. 38 . . .	1.20	0.31	15.87	22.67	—	1419	306
Poulard d'Australie . . .	0.27	0.31	16.46	21.51	—	1401	326
Turgido nero	0.12	0.28	15.67	23.24	0.02	1427	300
Dur di Portonovo	0.13	0.34	17.23	20.80	0.02	1400	348

(1) Energy equivalents of the digestible part of the forage, not reckoning all energy, that is to say substance, expended for their utilisation by the organism.

(2) Energy values of the forage in the production ration. The calculation has been made from the amount of meat and fat produced, according to Kellner's researches on adult cattle that were resting, by each group of food principles when these are added *separately* to a good maintenance ration. From the total thus obtained have been deducted the calories equivalent to the work of digesting the cellulose which, in straw, accompanies these groups of simple nutritive substances.

der the same conditions, present when perfectly ripe, small differences of composition, which appear without exception to be in harmony with the type to which the variety belong.

On an average, the wheats most resistant to lodging have a more ligneous straw (culms and leaves), but this correlation is not always found.

3) *Forage Value for Feeding Cattle.* — The nutritive values of the straws examined are given in the annexed Table; the straws contain no digestible albumen, this result is obtained because the digestibility coefficient of the crude proteins is so low (4 %) that there remains of their total, which is ½ or ⅓ that of meadow-hay (11 %), only non-albuminoid nitrogenous substances.

When straw is fed as forage, the authors recommend that it should be chopped into small pieces of about 2 cm., and not ground; otherwise it would not be sufficiently penetrated by the saliva, and might produce constipation. They advise feeding it 3 times a day, and that the cattle should be gradually accustomed to this very fibrous diet.

With the exception of the Dur de Portonovo wheat (which, because the climate of Bologna is damper than that to which it is accustomed has an abnormal composition, being poor in cellulose, but also in protein and phosphoric acid), the Rieti straws of the Cologna and awnless Gentil Rosso types are the best and least fibrous. The differences are, however, so slight that it can be concluded that the choice of straws for forage, provided these have properly ripened, should be governed more by their appetising qualities than their composition.

1136 – Contribution to Our Knowledge of the Toxic Products of New Hay. — ZCHOKKE, E. (Beobachtungen über Vergiftungen mit Neuheu), in the *Schweizer. Archiv für Tierheilkunde*, Vol. LXIII, Part 5, pp. 192-202. Zurich, May 1921.

Although it is well known that new sweating hay sometimes disagrees with animals, especially horses, the scientific explanation of this fact has so far little foundation. The author, who bases his statements upon LAUPPER'S observations on the spontaneous combustion of hay (1), concludes that, in new hay, chemical decomposition takes place resulting in the formation of extremely toxic substances. This decomposition is due, in the first place, to the action of enzymes, which on being set at liberty in the dying plant, cause a rise of temperature varying from 40°-45° C.

At this temperature, the conditions are favourable to the growth of many fungi that at once produce actual fermentation. Besides the *Mucorineae* and species of *Aspergillus*, the following micro-organisms also appear: — *Bact. coli, Bact calefactor, Oidium lacti, Bact. fluorescens liquefaciens, Bact. fluorescens non liquefaciens, Bact. herbicola aureum, Bact. herbicola rubrum, Bact. mesentericus vulgatus, Bact. mycoides, Bact. Zopfii, Bact. aerogenes, Bact. megaterium, Bact. levans* and, especially, the thermophilous species, *Actinomyces Thermophiles, Thermomyces lanuginosus*, and *Thermoascus aurantiacus*, which can raise the temperature up to 73° C. During this time, evaporation takes place in the hay, and the water condenses on the cold parts. Probably metals such as iron and manganese, that can act even if only traces are present, bring about, like actual catalysts, oxidation phenomena (raising the temperature to 280° C), thus causing the formation of different new products. It is doubtless the iron which plays the rôle of fire-carrier and induces the ignition of the heated hay.

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(1) See *R.* April 1921, No. 440; See also *R.* Dec. 1914, No. 1145. (*Ed.*)

The products of this chemical decomposition are volatile compounds, ethereal oils, and although these gradually evaporate and finally completely disappear, while present, they endow the hay with certain toxic properties. The author further mentions a fact showing that toxic products can be formed even in old hay, if it be exposed to great heat. A fire having broken out in a barn, 65 cattle were taken back to the cow-sheds some days later. Suddenly 15 of these animals were seized with diarrhoea, drowsiness, violent palpitations of the heart, while eczema made its appearance on their backs, etc. The origin of all these symptoms could be traced to the rain-water dripping off the barn after having passed through the heated hay that was even partly carbonised by the fire. The drops falling on the animals' skin cause actual dermatitis, and gave rise to internal troubles when they found their way into the food in the feeding-troughs. Experiment proved that this water had fatal effects upon rabbits and mice.

All the observations made on the formation of these poisonous substances may be summarised as follows :— The quality and quantity of the new products arising in fermenting hay depend on its composition and degree of maturity, the micro-organisms developing in it, and the intensity of the fermentation process.

Since this phenomenon cannot be prevented, the time-honoured precept of never using new hay till 3 months after it has been made, should be scrupulously obeyed.

1137 - **Researches in Austria on the Acidity of the Most Important Cattle Foods on the Market.** — WILK, L., in the *Zeitschrift für das Landwirtschaftliche Versuchswesen in Österreich*, Year XXI, pp. 202-203. Vienna, 1918; Summarised in *Biedermann's Zentralblatt*, Year XLIX, Part 7, pp 267-269. Leipzig, July 1921.

The author has analysed a good many cattle foods, and tested a sufficient number of samples of those given in the following Table, to enable him to divide them into sub-groups, and also to classify them according to their content in free fatty acids.

This table shows that the percentage of neutral samples, and of those poor in acids, never fell lower than 50, except in the cases of groundnut and sesame cake. It was generally above 60, and in the cases of the sunflower and maize residuum cake was as high as 80. The percentage of samples with a high acid content, which from a physiological point of view can just be regarded as permissible for stock-feeds, varied from 11.1 for sunflower-seed cake, to 21.0 for molasses feeds, *i. e.*, between $^1/_{10}$ and $^1/_5$ of all the samples.

The group of substances that were rich in acids, and hence liable to being already to a certain extent rancid, showed the greatest variation, and should only be used with extreme caution for feeding cattle. Hence, in normal times, 7.7 %-43.3 % of all the samples (from the maize residuum to the sesame cake) should not be fed to stock, or if given, special precaution must be observed

Percentage Distribution of the Samples in the Three Sub-Groups.

	Poor in acids and neutral Per cent	Average acid content Per cent	Rich in acids Per cent.
Pumpkin cake	63.7	20.5	15.8
Sunflowers-seed cake	78.8	11.1	10.1
Colza cake	69.5	20.7	9.8
Linseed cake	63.7	20.8	15.5
Maize residuum	80.1	12.2	7.7
Groundnut cake	43.8	16.6	39.6
Molasses feeds (« Melasse futter »)	70.5	21.0	8.5
Sesame cake	41.8	14.9	43.3
Rice meal	51.7	16.9	31.4

The author then mentions all the foods of which the fatty-acid content had been determined during the three years of the experiment (1915-1917). The foods are classed according to the oleic-acid content of the fat. The millet-meal (" Hirsefuttermehl ") contained most oleic acid, 91.66 % (as against 84.47 % in 1904) Horse chestnuts which had 4.58 % free fatty acids proved the most neutral of all the foods tested for oleic acid during the 3 years, although in 1914, hempseed cake (with 4.65 % free fatty acid) was the most neutral.

The author discusses the most neutral and most acid respectively of the commonest foods on the market. During the 3 years of the experiment, pumpkin-cake, with 0.44 % of free fatty acids, was the most neutral, whereas one groundnut cake proved the most acid

As the chief object of these researches was to determine the relation between the amount of fat and the percentage of free fatty acids, the author gives in another Table (basing his calculations on the data in the previous Table), the samples of foods that are respectively the poorest, and the richest, in fatty matter The poorest is a food containing molasses which has 0.33 % of fat, the richest, a pumpkin-cake with 29.9 %.

The author considers it of the utmost importance that these experiments should be continued, in order to obtain sufficient data to serve as a basis for the future compulsory determination of the quantity of free fatty acid present in cattle feeds, in order to estimate their quality and, within certain limits, their freshness. The results of the analyses, that have been made for 4 years (1914-1917) form a good foundation for this work.

[1137]

1138 - **Olive Pomace in Cattle Feeding.** — I. CUGNONI, C., in *L'Industria lattiera e zootecnica* Year XVII, No. 19, pp. 176-177; No. 22; No. 23, pp 226-227; No. 24, p 235. Reggio Emilia, 1919; Year XVIII, No. 2, 1920. — II. DE BENEDICTIS, A., *La Propaganda agricola* Series II, Year XII, No. 3. Bari, February 15, 1920. — III. DE PITARQUE Y ELÍO J., in *Hojas divulgadoras, Ministerio de Fomento, Dirección General de Agricultura, Minas y Montes*. Year XV, Nos 11-13, pp 11 and 15. Madrid, June-July, 1921

I and II. — The virgin pomace remaining after the olives have been pressed, as well as the exhausted pomace which is left when the oil has been extracted by means of a solvent, can be used as a cattle feed, provided they are separated by winnowing from the ligneous part of the stones and skins.

Prof. G. BRIGANTI (*La utilizzazione dei cascami dell'oliviculture nell'alimentazione del bestiame*, published by Frat. Jovane di Gaetano, Salerno), who has frequently studied the utilisation of this residuum, is of opinion that when the oil turns rancid, it produces great acidity in virgin pomace that has been kept for some weeks, and therefore it is unsafe to advise the use of this refuse as a cattle food until it has been ascertained, by careful experiment, that the acid fatty matter is not injurious to stock.

The question of the use of olive pomace has been again brought forward by Prof. C. CUGNONI, who carried out experiments on 3 cows at the « R. Stazione Sperimentale di Caseificio » at Lodi, in 1917, to determine the effect of virgin pomace upon the quality and quantity of the milk produced, and to ascertain any possible variations in the live-weight of the animals and their state of health. The experiment, which lasted 3 months, was divided into 3 equal periods of 30 days.

During the 1st and 3rd periods (the control period), a basal ration of hay + maize meal + bran + beets was fed to the 2 cows; during the 2nd period (experimental period), the bran was replaced by a quantity of pomace of the same food value, to which had been added (as it contains very little nitrogen) 15 % groundnut cake which is very rich in protein; that is to say, that 2 kg. of bran were replaced by 1.8 kg. of pomace plus 15 % groundnut cake.

The pomace used was very fresh, and had been freed from fragments of kernel by means of an ordinary wheat-separator after having been first spread out for 4 days on the floor of a well-ventilated room. The bran, maize flour, and pomace were fed as a mash. The cows ate the pomace at once, and during the time they were given it, increased slightly in live-weight, and yielded a little more milk. The milk was also richer and its organoleptic qualities were not in any way altered.

From the results obtained, M. CUGNONI concluded that: — 1) Virgin pomace, in order to be readily eaten and well utilised by stock, must be separated from the fresh unfermented residuum of olives; 2) it must be consumed as soon as possible, and not allowed to become stale; 3) well-prepared pomace, carefully-preserved to which other food substances have been added, has the same effect as wheat bran upon milk and fat production and upon the live-weight of the cattle to which it is fed; 4) in calculating the amount of pomace to be given, the total fat content of the ration must be taken into account; this ought not greatly to exceed the known maximum limits; if these are passed, the pomace would have an injurious effect by decreasing the coefficient of digestibility; 5) the transformation value of pomace is superior to that of bran, so that its use is much to be recommended from the economic standpoint.

III. — M. Joaquìn de PITARQUE Y ELío, director of the Stock Breeding Section of the " Granja-Escuela de Agricultura " of Saragossa (Spain) recommends, among other rations suitable for rearing stock, the following which contains olive pomace: — For *draught-oxen* weighing 5 to 6 quintals, silage of Gramineae and Leguminosae 15 kg + 5 kg. oats + 2 kg. olive pomace + straw *ad lib*; for *pigs that are being fattened* 5 kg. siloed pulp + 1 kg. chopped lucerne hay + 1 kg. maize grain + 0.5 kg. bean meal + 0.8 kg. olive pomace in the initial ration, and 4 + 0.6 + 1.5 + 1.0 + 0.5 kg. in the final ration.

The Tables in the Appendix give the composition of the olive pomace as follows: Dry matter 88.3 %; digestible proteins 4.3 %; digestible fats 13.10 %; digestible carbohydrates 30.8 %.

1139 - **Deficiency of Mineral Substances and Protein in Cattle Feeds as the Cause of the Licking Habit.** — See No. 1132 of this *Review*.

1140 - **A German Study of the Transmission of Coat Colour in Thoroughbreds.** — STERNFELD, R., in the *Zeitschrift fur Gestutkunde und Pferdezucht*, Year XVI, Part 4, pp. 69-76. Hanover, 1921.

An account, for the use of breeders of some researches on heredity in horses, and of the practical conclusions to be deduced from them as regards the breeding of thoroughbreds. (1) Since the colours most frequently met with in pure-bloods are bay and chestnut, both black and white being comparatively rare, researches on the hereditary transmission of coat colour are much simplified.

A) BAY AND CHESTNUT COATS. — The Author based his study on the data given in the " General German Stud book " (*Allgemeines Deutches Gestüt Buch*). By selecting from this material some chestnut stallions with numerous progeny, it was found that, in addition to many chestnut foals, there were a considerable number of bays, which is not surprising, seeing that many of the dams of the foals in question had bay coats. Where however the sires were bays, there were more bay than chestnut foals among the offspring.

Although it may be suggested that this phenomenon is due to the fact that thoroughbred stallions usually have bay coats and also, are seldom mated with chestnut mares, this does not solve the question, but only delays solution.

In addition to these bay sires, there is a small number of stallions, also bays, occupying a special position as regards transmission of coat colour. Thus, on examining the lists of the numerous progeny of Ard Patrick, Dark Ronald, Dolomit, Fervor, Pekin, and Manners, a black or white individual is occasionally found among bay foals of all shades, but never a single chestnut.

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(1) For more detailed information, especially as regards the fundamental facts see STOEVER, A. W., *Die Vererbung der Haarfarbe beim Vollblutpferde*. August Reher, Berlin, 1917.

There must therefore be two quite distinct classes of bay sires, seeing that there are no intermediate stallions between those begetting many chestnut foals, and those whose offspring are all bays. One of these classes produces a large number of chestnut foals, whereas the progeny of the second are all bays, no matter whether the stallions are mated with chestnut or bay mares, respectively.

It is evident that the reproductive cells of each individual contain certain factors which are different in the two classes of bay horses, that is to say, the character, presence of black pigment, is dominant as regards the character, absence of black pigment. Although the pedigrees of pure bays siring only bay offspring does not contain fewer chestnut animals than that of the impure bays, an examination of these pedigrees leads us to the important conclusion that each bay individual is the result of the union of two bay parents, whereas among the impure bays, there are many horses resulting from the mating of a bay or chestnut sire or dam.

Clearly it is necessary, in order that a bay individual may appear, that one of its two parents has transmitted the factor of the black pigment characterising the bay horse.

An impure bay will only have inherited this factor from one parent, whereas the chestnut animal will have inherited it from neither. Given that, as is well-known, each individual receives exactly equal hereditary portions from both parents, a pure bay horse has the factor for black in each reproductive cell, the impure bay in half the cells, and the chestnut has it in none of the cells.

Thus, if a bay stallion is mated with a chestnut mare, it is easy to see that 75 % of the resulting progeny will be bays (impure bays: pure bays = 2 : 1), and 25 % will be chestnusts. On the other hand, where a chestnut is mated with an impure bay, and an impure bay with a pure bay, 50 % of the foals will belong to each type.

Although, in practice, these theoretical results cannot be observed with the same regularity in each isolated case, yet a large number (hundreds or even thousands) of matings between impure bay sires and dams would always give, with almost mathematical accuracy, the proportion of 75 % bays and 25 % chestnuts. In the same way mating impure bay stallions with chestnut mares will always produce impure bays and chestnuts in the proportion of almost exactly 50 %, respectively, as is also proved by an examination of the Stud-Book.

B) BLACK AND WHITE COATS. — The union of 2 black individuals may at any time give rise to chestnut or black offspring, but never to bay foals ; this shows that the bay factor is dominant over the factor determining the extension of black. Consequently, a black foal can be obtained from mating two bays, or a bay and a chestnut. As regards the white horse, there is no question of the presence of a pigment, but on the contrary, of its absence from more or less of the hair, whilst the skin is pigmented.

It is thus evident that mating with a white horse may at any time produce a white individual, even if the parents are impure bays. On the other hand, unless one of the parents is white, the foals will never be white.

C) PRACTICAL CONCLUSIONS. — The practical consequences resulting from these laws of transmission can only be considered to a limited extent in actual breeding operations. Nevertheless, they enable paternity to be established with certainty in cases where it is doubtful. They also show perfectly clearly that each individual transmits only what is present in its reproductive cells, but that none transmits better or worse than another, i. e., prepotency is of no account in the transmission of coat-colour On the other hand, it would be a mistake to regard other characters as necessarily correlated with the colour of a horse's coat. A white animal may transmit the colour of its coat to all its offspring without transmitting its other characters to the same extent.

The author then discusses the alleged inferiority of pure-bred mixed bays as race-horses, which he proves to be a fallacy by reference to some lists of famous mixed (or impure) bay stallions and mares in Germany. Finally, in discussing the somewhat prevalent idea that, in the progeny of certain stallions and mares, a particular coat-colour regularly denotes a more satisfactory individual than other shades, and that the coat-colour may be a visible token of the transmission to an unusual extent of the prepotency of an ancestor having a coat of the same hue, the author remarks that though it may be possible to conceive that some connection exists between colour and performance (such as in racing), no such correlation has ever been established as regards the numerous characters determining the racing capacity of thorough-breds.

In the author's opinion, the importance of these laws of colour inheritance consists in the fact that the hereditary characters of an animal cannot be influenced by any ancestor, but on the contrary, the genetic constitution of the individual depends solely upon the characters directly transmitted to it by its sire and dam.

1141 – **Results of Measuring and Weighing the Different Classes of Half-Bred Horses, at the Chief Stud Station of Beberbeck (Hofgeismar, Hesse-Nassau).** — MÜLLER, W. in the *Zeitschrift für Gestütskunde und Pferdezucht*, Year XII, Part 5, pp. 96-100. Hanover, May 1921.

From measurements and weights of Belgian Rhenish draught-horses (1) recorded by Dr. HÜBENTHAL for the purpose of determining the development of the different parts of the body of these animals, it would appear that during the first year the increase in height is very pronounced, but ceases between the second and third year, whereas the chest continues to become deeper until the third or fourth year.

In order to obtain a general idea of the growth of half-bred horses the author proceeded, independently of HÜBENTHAL's work, to measure and weigh the young horses at the chief stud station of Beberbeck. As his examination of the animals was only of a preliminary character, he only determined the height at withers, the circumference of the thorax, the circumference of the cannon-bone, and the weight.

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(1) HÜBENTHAL, H., Messungstudien an rheinisch-belgischen Pferden, in *Der Tierzüchter*, Year 1920, Parts 8 and 9. (*Author*)

Table I gives a summary of the results obtained.

TABLE I. — *Average Growth and Increase in Live-Weight in 6 Months of Horses of the Classes of* 1917, 1918, *and* 1919 (1).

	Class 1919					Class 1918					Class 1917				
	Height at withers		Circumference of thorax	Circumference of cannon-bone	Live-weight	Height at withers		Circumference of thorax	Circumference of cannon-bone	Live-weight	Height at withers		Circumference of thorax	Circumference of cannon-bone	Live-weight
	Yardstick (1)	Measuring tape				Yardstick (1)	Measuring tape				Yardstick (1)	Measuring tape			
	cm.	cm.	cm.	cm.	kg.	cm	cm	cm.	cm.	kg.	cm.	cm.	cm.	cm.	kg.
Mares	9	6	17	1	75	4	3	15	0.6	70	1	2	10	0.5	50
Stallions.	8	9	13	0.8	100	5	5	10	0.4	75	4	5	5	0.7	38

(1) The horses were measured and weighed in the middle of April and middle of October 1920 (*Author*).

These zoo-metric data clearly show that the growth in height of the half-bred horse does not cease, as it does in the case of the draught-horse, at the age of 3 years. Taken as a whole, the animal grows more and increases more in weight during the first 3 years. Up to their third year, stallions are much heavier and more powerful than the mares, but then the difference becomes less.

Towards the end of autumn, 1919, more detailed measurements could be taken of the mares of the 1916 class. The results are given in Table II. The proportions and live-weight of these mares in November 1920 are given in Table III.

An examination of these Tables shows that all the half-bred Beberbeck mares, except 2, had not finished growing by the age of 4 years, since several of the animals gained 4 cm. in height after that time. In some cases, the height of the croup remained the same, in others it increased 5 cm. The depth of the chest increased in nearly all the mares as did also the length of the haunch, croup, and chest, the circumference of the thorax, and the live-weight. In 50 % of the cases, the circumference of the cannonbone was found to have increased.

As regards the treatment of the young classes, the author draws attention to the fact that, for the first three years, the animals were frequently turned out to exercise. The mares were served when about 3 ½ years of age.

TABLE II. — *Measurements and Live Weight of the Mares in 1919. of Classes 1916*

Name	Height at hers	Height at	Length of	Depth of	Width of	Width of c	Width of	Circumference of chest cm.	Circumference of cannon-bone cm.	Live weight kg.
Arbeit.	158	159	83.5	74.5	56	50 5	39	186	20	500
Cinxia.	160	159.5	86	74	56	51.5	41.5	184	19	488
Gänseleber	158	156	82	76	53	50.5	41	180	20	475
Ladenmädchen. . .	157	158	86	71	52	48.5	39	183	18.5	450
Opferschale	157	159	84	73	52	52	42	182	19.5	488
Ostgrenze	155	156	80	75	56.5	51.5	41	187.5	20	500
Pflanze	153	152	80.5	72.5	53	49	40	182	19	450
Silhouette	148	151	79	69.5	54	49	40.5	182	18.5	438
Tanzmusik	153	153	81	72	51	48	40	180	20	450
Tannagra	146	147	79	67	48	45.5	41	168	18.5	388
Tuba	162	164	84.5	77.5	54.5	51.5	42	178	19.5	525
Citter	156	159	82	74	55	49	41	183	19,5	463

(1) Distance from ground to lower edge of chest measured at about 10 cm. behind the front legs.

(2) Calculated.

(3) Measured at the height of the coxofemoral joints. (*Author*).

TABLE III. — *Measurements and Live Weight of Mares of Class 1916 in November, 1920.*

	Heigth at withers		Height at croup	Length scapula to Ischium	Length of legs	Depth of chest	Width of haunch	Width of croup	Width of chest	Circumference of thorax	Circumference of cannon-bone	Live weight
	Yardstick	Measuring tape										
	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm,	cm.	cm.	cm.	cm
Arbeit	160	166	159	165	82	78	59	52	45	188	20.5	600
Cinxia	162	171	162	169	85	77	60	54	45	190	20	588
Gänseleber . . .	162	169	161	160	86	76	56	53	43	184	20	475
Ladenmädchen .	157	166	158	161	84	73	55	50	42	185	19	550
Opferschale. . .	158	166	159	162	84	74	56	51	44	185	19.5	525
Ostgrenze . . .	158	164	158	172	80	78	57	52	45	192	20	588
Pflanze.	159	160	152	165	76	77	56	51	41	183	19	550
Silhouette . . .	150	156	151	156	77	73	55	50	42	187	19	509
Tanzmusik . . .	154	162	155	159	79	75	53	49	44	186	20	525
Tannagra. . . .	148	154	150	154	79	69	50	47	44	171	19	538
Tuba	161	172	166	172	87	77	56	52	44	189	20	600
Citter	158	167	159	160	83	75	56	51	45	188	19.5	525

1142 - **The Barb As an Army Horse.** — VERDIN, R., in *The Revue Agricole de l'Afrique du Nord*, Year XIX, No. 101, pp. 537-539. Algiers, July 1921.

In his work on the origin, shape, character and performance of the Barb or Barbary horse, the author draws attention to the fact that the present type of this breed differs greatly according to the place where it is found. Thus in the region of Till, where few if any attempts at breeding are made, the animals are smaller than those in the Hauts-Plateaux, but more strongly-built, have thicker legs, a longer and stronger head with more powerful lower jaw, short strong loins, rounded croup, and rather thick hocks; in short these horses show little trace of good blood. On the other hand, beyond Till, in the region of Tiaret, in the plain of Aribs, near Aumale, in the plains of Mina and Relizane, Châteaudun du Rhummel, Ain-M'lila, Barika, Batna, and Kenchela, in the district of Setifia, M'Sila, etc., the Barb has all the characters that fit it for a good saddle or army horse.

It is larger, more handsome, shows its high breeding ; its head is expressive, the eye full and large, and the whole animal is symmetrical Horses from these districts are very suitable for improving the Barbary race. Beyond the Great Plateaux, the Barb of the Sahara is gradually replaced by the " mehari ", which is a very efficient substitute. This type is chiefly kept by the principal native families. The animals differ little from those of Tiaret and Boghar, but give more evidence of breeding; they have a spare frame, their sinews are strong, standing well apart, their feet are small, and they are very sure-footed.

In spite of the remarkable qualities of the Barb as regards endurance, hardiness, thriftiness, resistance to discase and high standard of health, the war has brought out its defects as an army horse. These faults could, however, easily be remedied by selecting the best type of animal with a dark coat, refusing all unsuitable animals at the service Station, and making every effort to obtain dark-coated stallions and brood-mares.

On account of the trouble caused by the perpetual excitement of entire horses, the author advocates the compulsory castration of all army horses.

1143 - **The Sardinian Donkey** (1). — MORESCHI, B., in the *Giornale di Agricoltura della Domenica*, Year XXXI, No. 35, p. 275, 1 fig. Piacenza, August 15, 1921.

After Spain, Italy is the country possessing most donkeys. According to the 1918 census, there were then 949 162 of these animals in Italy as against 875 728 in 1905. The great increase in the last 10 years is due to the war, for nearly half the horses and mules were taken for military purposes from the various districts, so that their place had to be filled by donkeys. Over $^1/_5$ of the donkeys of Italy (205 000) are to be found in Sicily. The whole Valley of the Po has less than 150 000, but Southern Italy is far better off, and Sardinia has 35 000 donkeys and possesses a special breed.

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(1) See E. MASCHERONI, *The Rearing of Donkeys and their Crosses with Horses in Italy and her Colonies*, in *R*. February 1920, pp. 130-138. (*Ed.*)

The Sardinian ass probably belongs to SANSON's " African species ". It is characterised by its small height (about 90 cm.; rarely, 1 metre), the great uniformity of the type, its symmetry, except as regards the head, which is too heavy, the solidity of its skeleton, and its grey coat with the Saint Andrew's Cross.

As it is very docile, this donkey does not need breaking in. It begins to work when about a year old, and acts as beast of burden, riding or draught animal. It is also used to work the *norias*, which raise the water required for watering the kitchen-gardens, etc. The Sardinian donkey can carry about 220 lb., and draw a vehicle with a load of some 880 lb. It is very thrifty, living on roadside herbage, or when there is no work and it is turned out on waste ground, upon a handful of barley and a little chopped straw.

Before the war a Sardinian donkey cost from 20 to 50 *lire*, but in 1919 the price was 300 *lire*, and is now still higher. This increase in price is largely due to the fact that they are much in request since it has been discovered, that the flesh of the Sardinian donkey is tender and delicate, and can hardly be distinguished from veal.

The coat is usually grey, but sometimes dark-brown, with light areas on the inside of the thighs and round the eyes and mouth; this perhaps is a sign of crossing with SANSON's " European species ", though in reality, the so-called European and African species are nothing but varieties.

In Asinara, there is a breed of donkey that has become wild; most of them are grey, but albinos frequently occur. These animals are easily domesticated, and possess unusual strength.

Occasionally donkeys like the grey ones in shape and size, but with black or dark-brown coats free from any white areas, are to be met with in Sardinia.

Owing to its small size, the Sardinian donkey cannot be used for mule-breeding, which is in fact not practised in the island.

1144 – **The Cattle of Central Laos and Siam** (1). — SEILLIER, E. A. (Directeur des Etablissements Lapique à Napê, Laos), in the *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year III, No. 7, pp. 220-224. Saigon, July 1921.

In his article on the importance and methods of live-stock rearing in Central Laos and Siam, the author says that the chief cattle-breeding districts are the Province of Savannaket, the south of the Province of Cammon (Valley of Se Bang-Fai in Siam), and the Provinces of Lakhone and Nong-Khai, all districts where cattle are numerous.

As the inhabitants of these provinces consume little beef, they are able to send a considerable amount to the two great markets of the south : Korat (Siam), Kratia (Cambodia), and to Thaket, whence it can be despatched to North Anam, since a cold-storage plant has been installed at Ben-thuy. The number of animals exported annually (5000 to 6000 from the three Siamese provinces) is relatively large, and the author foresees that the cattle industry will develop greatly in the future, as soon as a better market becomes available, for there are large areas of uncultivated land that are wholly unsuited to rice and many years must elapse before other crops can be grown. Further, the registration of cattle which has now been enforced for some years in Siam, and will soon be extended to Laos, offers a certain guarantee against theft, and will therefore contribute to encourage Stock-breeding.

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(1) See *R.* March 1919, No. 333. (*Ed.*)

BREEDS. — The cattle of Laos and Siam are composed of a mixture of types, and it is thus extremely difficult to determine any distinct breed. Two pigments are met with, the coat-colour varying from ebony black to white, and passing through all the chromatic scale of greys, reds, and wheat colour. Some of the animals have long lines, but most of them are short. In spite of the great differences existing between the various shapes and colours of these animals, the author believes that he has succeeded in distinguishing a type which, from its frequent occurrence, may be regarded, if not as a race, at any rate as a sub-race, for it seems quite fixed, and is perpetuated, in spite of the mixtures and degeneracy involved by the total absence of a breeding system in the country. The characters of this type are as follows — Short lines, very short head, broad forehead, horns slightly raised and spreading, body cylindrical, legs fine, chest not deep, coat brown-black with a mahogany or brown mule-stripe on the fore-hand, and a grey one on the hind-hand, slightly humped. On the whole the animal is small, but well-shaped, with little bone ; its weight at the age of 6 years varies (without fat), between 269 and 300 kg. Of the other cattle, some are distinctly of the Hindoo, and others of the Yunnan type, which is easily explained by the intercommunication between Siam, Burma, and China.

BREEDING. — There is no system of breeding : the calves, bulls and cows are born, grow and reproduce their kind without any interference on the part of the owner, who often does not know how many cattle he possesses, and does not trouble about them in any way. The animals that survive have evidently good constitutions. On the other hand, as a result of this method of rearing, they are very wild, and can only be caught with the greatest difficulty. The best months for calving appear to be December and January. The calves are born in the dry season, and thus are sufficiently old to stand the heavy rains which begin in June. Very few calves are born before December or after January. Cows that have calved in December or January, do not come again in heat before April or May.

BULLS. — As the native does not scruple to castrate all the fine bulls, in order to obtain good draught oxen, the only animals left for breeding are small or badly shaped. The method adopted for castration is very primitive, and consist in crushing the testicles, so that often this incomplete operation is useless, for the testicles only develop to a less extent.

FEEDING. — The animals are out at grass all the year and housing is quite unknown. The chief forage during the dry season, when the grass is scanty or tough, consists of the ricestraw left on the fields after threshing, or of the stools that are still standing. This food, which the cattle eat with avidity, appears to be well assimilated, since in spite of its low nutritive value, they do not become thin, although given no other rations. In January all the fields are set on fire (1) and until the grass has grown again, the stock have to content themselves with what they can find. Since, however, the number of head is very small in comparison with the vast areas they range, the cattle do not lose much flesh, and get on quite well until the grass shoots plentifully once more, after the usual February rainfall.

Dressing-yield. — An appended note gives the dressing yield of the cattle reared in Laos and Siam. The author mentions the following interesting details :— The carcasses of Laos oxen weigh from 120 to 220 kg., the average weight being 150 kg. without the head. In spite of their somewhat light weight, these animals have not the defect characterising most primitive races, viz., that owing to the poor development of the muscular tissue, the proportion of net meat to gross weight is much less than in the European breeds (2).

The formation of the Laos animal (round croup, cylindrical body, and great muscular development) renders its meat yield equal to that of European cattle of the first quality ; it is the thickness of the chine and sirloin that increases the percentage of net meat and makes these oxen so valuable.

The chest is rather high, but thick ; there is little flesh on the flat ribs. To sum up : the Laos ox has no hump and when highly fed, these animals run more to meat than fat. Meat covered and streaked with fat is of rare occurrence. When the bulls are castrated young, the beef is fine-grained. At present, however, the animals slaughtered are bulls (or oxen that have been castrated), from 2 to 3 years of age, so the meat is rather coarse.

Conclusions. — From the above facts, the author believes himself justified in concluding that the cattle of Laos and Siam, like those of Tonkin and Anam, are degenerating, as they have reached the critical stage when degeneration proceeds rapidly. The author however hopes that as a result of selection a presentable herd may be got together in 10 generations from the elements present in the country itself, or in the neighbouring States. In his opinion, the best method of selection would be to retain all the bulls and cows of the required type for 6 generations. From the 7th generation, it would be possible by carefully sorting the bulls, or by introducing new bulls of perfect shape, to breed for lighter bone and for muscular development, by intercrossing the animals until the desired type was fixed. No improvement in the milk yield could be expected, for owing to local climatic conditions, the breed would never produce good milch cows.

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(1) This annual burning of the fields appears to produce no effect upon the cattle parasites (ticks, leeches, etc.). (*Author*)

(2) According to data sent to the *Bulletin Agricole de l'Institut Scientifique de Saïgon* by M. Le Louet, Chief of the Cochin-China Veterinary Service, at the Saïgon abattoir the average return $\frac{\text{net-weight}}{\text{live-weight}}$ varies between 45 and 52 %. (*Author*)

[1144]

As regards the quality of the meat and the dressing yield of the Laos and Siam cattle, the beef is fairly good in quality, and there is less waste than with meat from Australia and Argentina where, owing to the introduction of English breeds (especially Shorthorns), there has been a tendency to develop unduly the fatty tissues to the detriment of the muscles.

1145 - **The Cattle of French Guinea.** — *La Revue Générale du Froid et des Industries Frigorifiques*, Year II, Vol. II, No. 6, p. 206. Paris, July 1921.

Guinea possesses numerous sources of wealth, and among the most important, is its large stock of cattle, which is capable of still further increase. The finest herds are to be seen in the region of Fouta, which is inhabited by the *foulas*, an ancient race of nomadic shepherds. The animals are usually small, but sturdy and in good condition. During the winter they graze on the grassy plateaux, and during the dry season feed in the great deep valleys that intersect these plateaux. Like all the other herds of the country, these herds have decreased owing to outbreaks of epizootic disease of varying severity, of which the consequences must not be denied or exaggerated. It has often been stated that the cattle of Guinea had lost all their value, having been decimated by terrible pests. This is fortunately not the case, and now, as in the past, the Fouta remains the source of supply from which the neighbouring countries of Senegal, Sudan, Portuguese Guinea, and especially Sierra Leone, obtain their cattle. During the war, the provisioning of the troops, and the large consignments of cattle sent to the Cold Storage Factory, at Lyndiane, contributed to the impoverishment of the Guinea herds. The value of the stock, however, which is still considerable, is estimated not to have been reduced by as much as $^1/_{10}$. Statistics show that Guinea cattle still number about 400 000 head, and probably this figure, which is based upon the returns of the natives, who do not like the full amount of their possessions to be known for fear of increased taxation, is far too low. The number of cattle exported, which in 1914 was over 12 000 and reached 17 000 during the war, now tends to decrease. In 1919, hardly 7000 head were exported, and in the three first quarters of 1920, there was a further drop to below 3000.

This is due to the efforts of the Government which is doing its best to restrict exportation. It should be remembered however, that as the Custom Offices are very far apart, there is much opportunity for fraud on the land frontiers, so that probably the figures returned are much below the truth, and can only serve to give a rough idea of the real number of cattle leaving the country.

The number of raw cow-hides exported affords a good means of estimating the size of the herds. Since 1913, the average weight of hides exported amounted to 1000 metric tons which represents, assuming the average weight of a hide to be from 12 to 15 kg., more than 8000 animals sent to the abbattoir. If to this number are added the average exportation returns viz., 10 000, the normal annual loss of the herds would be 18 000 to 20 000 head, which does not appear excessive. From these observations, it may be concluded that the cattle of Guinea have not been reduced to the extent alleged and that, if were systematically managed, they might be a source of large revenue to the Colony.

1146 - **Experiments Made in the United States on the Effect of Hydrocyanic Acid in Sudan Grass on Cattle.** — SWANSON, C. O in *Journal of the American Society of Agronomy*, Vol. XIII, No. 1, pp. 33-36. Washington, Jan. 1921.

As occasional cases of poisoning of cattle due to eating Sudan grass (*Sorghum exiguum*) had been observed, the Dairy Department of the Kansas State Agricultural College conducted experiments in 1919, with 6 Holstein cows put to pasture from July to October on a plot of 5.4 acres of Sudan grass. Samples of this grass were tested for hydrocyanic acid content. In October 2 other cows which had not eaten any Sudan grass were placed in this pasture. The following is a summary of the first results obtained: —

Although hydrocyanic acid was found in large amounts in Sudan grass used for pasture, no harm resulted to the cattle.

Liberation of hydrocyanic acid is apparently associated with enzyme action. Digestion in water at room temperature for several hours and subsequent distillation gave larger amounts of hydrocyanic acid than if sulphuric acid was added. Hot water and dry heat diminished the amount of hydrocyanic acid obtained, whilst slow drying caused it to disappear. Tests made on wilted samples or those several days old may be considered as worthless. Tests made immediately on frosted grass gave very high amounts of hydrocyanic acid, but this disappeared rapidly as soon as the plant began to wilt and was completely dispersed when the plant was dry.

While in the case of the two cows who had never previously eaten any Sudan grass there seemed to be no ill effects, under other conditions it was proved that immunity was not due to habituation.

These results do not permit any definite conclusions to be drawn but it is proposed to extend the investigations.

1147 - **German Experiments on the Value of Urea in the Feeding of Sheep and Other Ruminants.** — VOLTZ, W., in I. *Mitteilungen der Deutschen Landwirtschaftsgesellschaft*, Year XXXIV, No. 27, pp. 372-375. Berlin, July 1919; II. *Biedermanns Zentralblatt*, Year XLIX, part 7, pp. 269-272. Leipzig, July 1920.

In view of the fact that at the present time in Germany the amounts of vegetable protein required for feeding cattle are inadequate, the question of the substitution of amides and especially synthetic urea for vegetable protein has become of great importance. As a preliminary experiment gave encouraging results, further experiments were undertaken with sheep. The typical ration consisted of rye husks and chopped rye-straw, both disintegrated, dried and finally ground ("Strohstoff"), prepared according to the BECKMANN method (1) through the action during varying periods of a 1.5 % caustic soda lye. The protein content of the " Strohstoff " was estimated by the STUTZER method. The amounts of digestible protein were so minute that they could not be in any way considered to be connected with the possible formation of animal protein; moreover these amounts were far less than the amount accumulated in the tissues.

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(1) See *R.* April 1921, No. 406, III. (*Ed.*)

In addition the animals were fed on boiled starch and sugar or the equivalent starch value in the form of starch alone. The daily dose of urea was at the rate of 30 grammes per head and the ration was completed by the addition of mineral salts. The animals which were of the long haired Merino variety (*Kammwoll-Merino*), nine months old, and each weighing from 20 to 30 kg. at the beginning of the experiment, received daily the following amounts of mineral salts:

Calcium carbonate . . .	15 gm.	Potassium sulphide.	1 gm.
Sodium	5 »	Magnesium oxide.	1 »
Sodium phosphate . . .	4 »	Iron chloride	0.2 »
Potassium sulphate. . .	4 »	Total of food salts.	30.2 gm.

No compounds containing iodine or fluorine were given. The potassium sulphate was reduced by the intestinal bacteria. Although the feeds given could not contain any vitamines, the author did not trouble to provide special feeds rich in these substances, as he thought that the bacteria digested by the sheep contained them in sufficient quantity. As a matter of fact, during the whole period of the experiment (over six months) the general condition of the animals under the special treatment was never impaired.

As regards the utilisation of urea, experiments with three lambs gave identical results which are not quoted by the author, who only gives the results of a long series of continuous experiments made with one lamb. These results (see Table annexed) afford convincing proof that urea is a perfect substitute for vegetable protein in feeding-stuffs.

Throughout the series of experiments the faeces always contained 25 % more protein than the vegetable foods in the ration. For the proper growth of the wool 0.7 gm. of nitrogen had to be absorbed daily. The lamb's fleece contained 87.39 % of dry matter and 9.95 % of nitrogen.

Growth of wool during the 155 days of the experiment	1090.5 gm.
Growth of other epithelial products, about	100.0 »
Increase in weight reckoned for the 155 days . .	7556.8 »
Weight of the lamb on the first day of the first period	kg. 29.25
Weight of the lamb on the last day of the seventh period	» 37 15
Actual increase in weight . . .	7900 gm.

The ratio between the increase in weight, reckoned on the balance and the growth of wool, and that resulting from the actual weighing may be considered as quite satisfactory, the latter being 343 gm. (4.5 %) only in excess of the former.

The author them deals with the question of the synthesis of protein in the animal organism and quotes the thesis of ABDERHALDEN (1), which

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(1) Lehrbuch der physiologischen Chemie, Third edition, Part II, p. 1407.

Results of feeding experiments lasting 155 days with one lamb using urea as the sole source of nitrogen

Period No	Duration of the experiment	Food consumed per day	Nitrogen content of ration	Nitrogen expelled			Balance of nitrogen	Protein fixed by the animal	Live weight	Temperature of stall	Nitrogen value of ration	
				in urine	in faeces	total					per head	per 1000 kg of live weight per day
	days*											
1	17	500 gm of husks disintegrated for 18 hours, 100 gm of starch, 100 gm of sugar, 30 gm of urea and 10 2 gm of salts	17 23	11 63	3 94	15 57	1 66	10 4	29.94	11° 1 C	474 5	15 8
2	26	625 gm of husks disintegrated for 18 hours, 100 gm of starch, 125 gm of sugar, 30 gm of urea, 35 8 gm of salts	18 03	9 26	6 52	15 78	2 25	14 1	35 51	8° 1	537 9	17 1
3	25	625 gm of straw disintegrated for 21 hours, 125 gm of starch, 125 gm of sugar, 30 gm of urea, 30 2 gm of salts	17 08	8 13	5 72	13 85	3 23	20 2	33.40	6° 8	490	11 7
4	18	625 gm of straw disintegrated for 3 hours, 125 gm of starch, 125 gm of sugar, 30 gm of urea, 30 2 gm of salts	17.25	7 81	6 75	14.55	2 69	16 8	34 70	7° 2	454 5	13 1
5	22	625 gm of husks disintegrated for 3 hours, 120 gm of starch, 125 gm of sugar, 20 gm of urea, 20 2 gm of salts	18 14	10 01	6.54	16 55	1 58	9 9	34 29	1°9	471 0	13 7
6	24	625 gm of straw disintegrated for 72 hours, 122 2 gm of starch 125 gm of sugar, 20 gm of urea, 30 2 gm of salts	16 19	8 22	6 12	14 34	1 84	11 5	35.56	11° 6	467 7	13 2
7	23	625 gm of straw disintegrated for 72 hours, 22[illegible] 4 gm of starch, 125 of sugar, 30 gm of urea, 75 5 gm of salts	16 02	7 42	6 80	14 12	1 81	11 3	36 98	10° 0	525 7	14.2

lays down, that, in non-ruminants, urea cannot be utilised for flesh formation. This theory is further supported by the works of WEISKE, ZUNTZ, C. LEHMANN and especially M. MÜLLER. According to the author KELLNER's theory, according to which amides are never utilised by the animal organism except in rations deficient in protein, cannot be maintained. Amides on the contrary should always be added to digestible protein and in feeding rations the amount of nitrogenous food material should be determined by the amount of digestible nitrogen.

1148 - **The Marseilles Breed of Pig.** — GOUIN, R., in *La Petite Revue agricole et horticole*, Year 27, No. 633, p 123. Antibes, August 28, 1921.

The author draws attention to the good qualities and defects of the Marseilles breed of pig, and suggests improvements which he thinks could be advantageously introduced into the method of rearing.

The Marseilles pig has not yet attained a uniform type, but gives evidence of being the results of various crossings. It is remarkably prolific, the average litters containing 8 to 12 young, while litters of 14 are common. A sow farrowing three times in the year can produce 40 pigs annually.

The young animals do not mature quickly on account of wrong feeding at the time of weaning, so that the pigs take too long to increase their weight from 12 to 20 kg. As the breeder has no milk products, he uses nothing but wheat offal, which too often contains inert or even poisonous substances. The author especially advises the larger and more systematic use of groundnut cake which should be broken up into quite small pieces, or powdered, and added to the warm or cold rations at the moment of feeding. By changing the diet in this way at the time of weaning, it is easy to gain a month.

Another very common fault of the breed is the excesive length of the pasterns. This can be remedied by selection, but the addition of bone phosphate may also assist.

To prevent outbreaks of infectious pneumo-enteritis, the author says that the animals and their sties should be kept scrupulously clean.

1149 - **Pig-Breeding on the Hills of Piedmont** (1). — VOLANTI, A (Zootechnical Section for the Province of Alexandria), in *Il Coltivatore*, Vol 67, No 23, pp 141-145, 5 figs. Casale Monferrato, August 20, 1921

On the hills of Alexandria, excellent results have been obtained by crossing the Large White Yorkshire, an improved breed, with the local Reggio breed. The conditions obtaining in the district are well suited to the Large White, for small holdings predominate, there are plenty of vineyards and trees, and few dry meadows; further, the pigs are reared in sties.

The Large Black Yorkshires have also been tried, but with less success (at all events so far as the pure-bred animals are concerned), for they are not so well adapted to home-rearing as the Large Whites. On the other hand, their products are preferred by the pork-butcher.

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(1) For further details on pig-breeding in Italy, see *R* July-August 1920, No. 779; *R.* June 1921, No 658; *R.* August 1921, No. 842; *R* September 1921, No 939 (*Ed.*)

If the local breed is crossed with the Yorkshire (either Large White or Large Black), the hybrids are most prolific, the litters often consisting of 11 piglings instead of the 6 or 7 usually farrowed by the Reggio sow.

1150 – German Experiments Made on Feeding Pigs with Rations Containing Large Quantities of Fish Meal. (1) — MÜLLER, K. (Direktor der Versuchswirtschaft für Schweine haltung, -fütterung und -zucht in Ruhlsdorf Kreis Teltow), in the *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, No. 32, pp. 333-334. Hanover, August 1921.

With a view to deciding to what extent the amount of fish meal could be increased in fattening pigs without detriment to the health of the animals and the quality of the meat, experiments were carried out in 1920-1921 at the experiment farm at Ruhlsdorf for the keeping, feeding and breeding of swine.

The experiment was divided into 2 periods, each lasting 4 weeks. During the 1st period, the animals were fed fish-meal, potatoes and beets, and during the 2nd, potatoes entirely took the place of the beets. Eight pigs born in July and August respectively, which weighed at the end of the year 50 kg. on an average, were used; 5 of the animals belonged to the improved native breed, while the 3 others were crosses between it and Yorkshires, Berkshires, or Hildesheim pigs.

During the whole period of observation, the animals showed no serious symptoms, which is a fact worthy of notice, seeing that they consumed large quantities of fish meal containing much more sodium chloride than is normally present in commercial meal. The composition of the meal used in the experiments was as follows:— Crude protein 60.20 %; crude fats 1.17 %; sodium chloride 6.43 % : the crude protein content was thus higher than the average (52.5 %), whereas the crude fat content was below the average (2.1 %) which had much to do with the fact that the quality of the meat and fat of the animals fed on this flour was not affected.

The potatoes (" Professor Wohltmann ") given to the pigs during the experiment contained 14 to 16 % of starch; the beets were of the half-sugar variety known as Meyer Friedrichswerth's " Zuckerfutterwalse ", with a dry matter content of 15 %.

After having accustomed the pigs to larger amounts of fish-meal, the first experimental period (Feb. 3-Mar. 2, 1921) was entered upon; during this, the animals ate potatoes *ad lib.* and a mixture of 16 kg. of beets to 0.9 kg. of fish meal. The amount they consumed may be regarded as fairly satisfactory. During the 2nd period (Mar. 14-April 10), they ate to satiety a mixture of 16 kg. of potatoes and 0.6 kg. of fish-meal; as there were no beets in the ration, the consumption was less than in the 1st period.

(1) See *R.* Dec. 1915, No. 1356. (*Ed.*)

Details relating to the food consumption and the increase in weight of the pigs during these two experimental periods are given in the annexed Table: —

Food Consumption and Increase in Live-Weight During the Two Periods of Experiment with Fattening Pigs.

Period	Amount of food consumed per head and per day kg.	Composition of ration			Average increase in weight per day and per head	Amounts of food necessary to produce 1 kg. of live-weight		
		Fish Meal	Potatoes	Beets		Fish Meal	Potatoes	Beet
1	14.30	0.39	6.95	6.95	0.603	0.64	11.53	11.53
2	10 64	0.39	10.25	—	0.639	0.61	16.04	—
Average	12.47	—	—	—	0.621	—	—	—

Although it may be said that with a ration of different composition, the amount of food consumed daily might have been about 2 kg. more, the quantity actually eaten was satisfactory.

The pigs consumed considerable quantities of this ration (upon which they were exclusively fed), seeing that their daily food contained as much as 0.39 kg. of fish-meal. Assuming the percentage of digestible protein to have been at least 50, each animal thus consumed with the fish meal 200 gm. of digestible protein.

The ration contained nearly exactly the amount of digestible protein (255 gm.), and the starch values (2.05 kg) necessary according to KELLNER to fatten pigs, so that the increase in live-weight ought to have been sufficient. It was not so however, for the average only rose to 621 gm. per day, whereas in other fattening experiments made in the winter of 1920-21, at the experiment farm, the daily increase in live-weight was 840-920 gm., being thus from 200 to 300 gm. more than when the pigs were given large amounts of fish-meal.

From what has been said, it is evidently possible to fatten pigs on rations consisting exclusively of potatoes and fish meal; a satisfactory result must, however, not be expected. It is probable that the animals would have put on more flesh, if only half as much fish meal had been given them (200 gm.), other foods rich in protein being substituted for the remaining half.

An estimate of the returns shows that considerable quantities of food are necessary to produce 1 kg. increase in live-weight, at all events, during the first period. As regards the second period however, the amount of food consumed is more in accordance with the figures obtained in previous fattening experiments. In any case the experiment cannot be said to have been successful from this point of view.

The increase in the individual live weight of the animals during the time the experiment lasted (Feb. 3-April 10, 1921), was as follows:—

Local improved breed (5 pigs): 26 + 28 + 39 + 29 + 42 kg.; average 35 kg.

Cross-bred pigs (3 animals): 41 + 31 + 32 kg.; average 35 kg. Thus the average increase in weight in the two groups was exactly the same. At the same time, there were marked differences. so that the average results must be regarded as due tc mere chance.

The figures given for the 3 first animals of the improved local breed represent the weights of pigs from the same litter, but the very fact that the first pig gained less live-weight than the other two, shows that it is not satisfactory, in this case, to have compared animals of the same litter The two last pigs of the improved breed were the offspring of one boar, but of two sows of the same ancestry, yet they fattened very differently. As regards the half-breeds the largest increase in live-weight was gained by the product of a cross (Large Yorkshire ♀ × Hildesheimer) ♂ × Large shire Yorkshire, whereas the other two pigs were the offspring of the cross Berkshire ♂ × local improved breed, and belonged to the same litter

As regards the young pigs of the best litter hitherto farrowed at the Ruhlsdorf Experiment Farm, none of them was able on this special ration to attain the average increase in live-weight for the fattening period.

1151 – **Bee-Keeping in the Trentino, Italy.** — BONI, G (Direttore dell'Istituto d'Agricoltura di San Michele sull'Adige, Trento), in the *Agricoltura italiana*, vol. XVII, No 8, pp 238-240 Ancona August 1921

Except for some portions of the Valley of the Adige and of the basin of Lake Garda, which are devoted to the intensive cultivation of the vine. the whole of the Trentino is eminently suited to bee-keeping, as are indeed all semi-mountainous or mountainous districts where the meadows, orchards and woods offer a rich and varied flora to bees.

Apiculture is a very long-established industry in Trentino. The agricultural College of San Michele has successfully carried out a most active propaganda for the substitution of a hive with moveable frames (preferably the SARTORI type), for the primitive construction used by the villager.

During the war, the bee-keeping industry suffered greatly, but is now beginning to revive, as the great demand for swarms, and the high prices they fetch, abundantly testify. The Provincial Agricultural Council of Trent, and the Agricultural Institute of San Michele are encouraging the reconstitution of this industry by providing travelling instructors and short theoretical and practical courses of lectures, the gratuitous distribution of hives (in future the Italo-American DADANT type will be the one selected for this purpose), and sending out experts to visit the bee-keepers. In the southern part of Trentino, the *aurata ligustica* bee has always been kept, but the black German and the gray Carnic breeds have penetrated into the northern valleys, so that hybrids resulting from crosses between the *aurata* and these two breeds are frequently found

1152 - Pisciculture in Switzerland in 1920 (1). — *Bulletin Suisse de Pêche et de Pisciculture*, Year XXII, No. 6, pp. 90-93. Neuchâtel, June 1921.

The following information has been taken from a Report issued in 1920 by the Swiss "Departement de l'Intérieur".

In 1919-1920, 208 breeding stations were working during the incubation period (as against 216 in the preceding year), and 146756000 incubated eggs produced 118 131000 fry, of which 117 302 337 (126 863 037 in the preceding season), were placed in public waters, including 185 337 fishes of 1 summer, or 1 year. (See table p. 1462).

The fry produced by incubation were as follows :—

(a) *Native species :—*

Salmon	1 223 000
Salmon-trout	68 000
Lake trout	3 990 000
River and brook trout	8 965 000
Salmo alpinus	3 372 000
River char	1 554 000
Corregones	82 253 000
Pike	16 403 000

(b) *Foreign Species :*

Fountain salmon	61 000
Rainbow trout	242 000
Total.	118 131 000

The Confederation granted 44 210 fr. to the Cantons for pisciculture, (39 700 fr. in 1919), chiefly for raising fry and stocking the waters.

1153 - Experiment Station of Pisciculture at Evois, Finland. — BROFELDT, P., Evois Fiskeriförsökstationen, Resultatet av dess 25 åriga verksamhet, 1892-1917, in *Finlands Fiskerier*, vol. VI, 1920. Helsingfors, Fiskeristyrelsen : Summarised in the *Allgemeine Fischerei-Zeitung*, vol. XLVI, No. 12, pp. 152-155. Munich, June 1921.

An Experiment Station with an annexed College of Sylviculture and about 7 200 hectares of forest under its management, was opened as long ago as 1892, at Evois, a small village 40 km. northeast of Tovastehus, one of the stations on the railway-line connecting Helsingfors with north Finland. Subsequently, a Piscicultural Experiment Station was started, to which in 1901 was added a School of Pisciculture. At the head of this Stations there is a Director (M. Pekka BROFELDT) assisted by a fisherman, who goes out fishing with the students and also completes the very complicated forms giving all data concerning the fisheries, and the various fish introduced into the numerous lakes and streams.

The station has under its supervision 27 lakes with a superficial area ranging from 1 to 50 hectares (total 260 hectares), and about 14 km. of watercourses.

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(1) See *R* Jan. 1921, No. 87 (*Ed.*)

The Work of the Swiss Fish-Breeding Stations During the Incubation Period 1919 1920

Cantones	Number of Stations	Fry obtained (in thousands)											Number of fish put into public waters under official control	
		Salmon (*Salmo salar*)	Salmon-trout	Lake trout (*Trutta lacustris*)	River and brown-trout (*Trutta fario*)	Rainbow trout (*Salmo irideus*)	American river char (*Salmo fontinalis*)	*Salmo salvelinus*	River char (*Thymallus vulgaris*)	Coregones (*Coregoni*)	Pike (*Esox lucius*)	Total	Fry (in thousands)	Number of fish of one summer and one year
Zurich	11	—	—	336	372	111	17	35	224	5 930	582	7 607	7 607	8 080
Berne	47	—	—	98	2 150	13	—	6	668	7 308	50	10 293	10 243	3 201
Lucerne	19	—	—	281	348	—	—	42	—	15 800	3 097	20 468	20 453	700
Uri	1	—	—	195	—	—	—	—	—	80	—	275	275	—
Schwyz	3	—	—	30	—	—	—	500	—	3 217	1 390	5 167	5 167	—
Upper-Unterwald	1	—	—	196	—	—	—	—	—	1 500	162	1 858	1 850	2 312
Lower-Unterwald	3	—	—	171	—	—	—	—	—	—	—	171	171	700
Glaris	1	—	—	108	122	—	—	—	—	—	—	230	215	500
Zug	4	—	—	8	16	—	—	1 740	—	4 945	5 035	11 774	11 774	—
Fribourg	6	—	—	—	612	—	—	—	—	7 051	77	7 740	7 735	37 701
Soleure	6	—	—	—	265	—	—	—	—	—	—	265	265	—
Bâle-Villé	1	848	68	—	101	—	—	—	—	—	—	1 017	1 017	—
Bâle-Campagne	5	152	—	—	180	2	—	—	—	—	—	634	617	—
Schaffhausen	1	—	—	—	120	—	—	—	268	—	—	388	388	—
Appenzell Rh.-Ext.	1	—	—	—	20	—	—	—	—	—	—	20	20	—
Appenzell Rh.-Int.	1	—	—	—	69	—	—	—	—	—	—	69	69	—
Saint-Gall	22	—	—	155	1 213	45	44	25	2	8 601	1 910	11 995	11 771	37 596
Grisons	3	—	—	—	280	—	—	—	—	—	—	280	191	2 117
Auergau	30	223	—	—	1 175	21	—	—	13	5 240	400	7 072	7 020	4 595
Thurgau	8	—	—	—	154	—	—	—	285	12 438	2 800	15 677	15 677	—
Tessin	17	—	—	329	424	50	—	1 024	2	2 130	—	3 959	9 956	7 230
Vaud	11	—	—	1 663	569	—	—	—	53	5 703	—	7 988	7 716	10 300
Valais	1	—	—	—	32	—	—	—	—	80	—	112	112	433
Neuchâtel	4	—	—	420	366	—	—	—	30	2 200	—	3 025	2 811	53 850
Geneva	1	—	—	—	47	—	—	—	—	—	—	17	47	15 992
TOTALS	**208**	**1 223**	**68**	**3 990**	**8 965**	**242**	**61**	**3 372**	**1 554**	**82 253**	**16 403**	**118 131**	**117 197**	**185 337**

The lakes are situated in the Kumoälv region. The country consists of sterile moors with stands of spruce and pine. The soil is sandy and stony, and almost entirely uncultivated; marshes and ponds abound.

The water of the lakes is usually turbid, and of a dark colour, it is only clear in 4 cases. It contains much humic acid and iron, but little lime. The bottom is covered with mud, which is usually soft and loose. The depth of most of these lakes is from 6 to 7 metres.

As a rule, the water is cool even in summer; the temperature at the bottom of the shallowest lakes (2 m.) never rises above 10° C., and usually remains below 4° C., though that of the upper layer may reach 20° C. in summer.

Most of the lakes are gradually being filled up by water-weeds.

The scanty flora on the banks consists of rushes, reeds, and pondweed (*Potamogeton*). Attempts have been made to increase the vegetation by the introduction of new species, but with little success, for all the nutritive matter available is used by the wild native plants. Under these conditions, the natural fauna, consisting for the most part of *Limnoea* and other molluscs, is very limited, although it is much more plentiful (as are also the fish) in 4 lakes in which flax is occasionally retted. In 4 small, manured fish-ponds there is abundant vegetation.

The plankton is very little developed: it consists chiefly of rotifers, copepods, cladocera, and the protozoon *Dinobryon.*

The natural ichthyofauna is chiefly composed of the following fish:— Perch (*Perca*), common roach (*Leuciscus rutilus*), common pike (*Esox lucius*). Other rarer species are:— a small perch, the "pope" (*Acerina cernua*), the lota (*Lota lota*), the "rudd" or "red eye" (*Leuciscus erythrophthalmus*) and the bleak (*Alburnus lucidus*). For the last 25 years, researches and experiments have been made to increase the fishing returns by stocking these poorly-provided lakes with new species. The following have been placed in the water:— Perch (*Perca lucioperca*), *Micropterus salmoides*, tench (*Tinca tinca*), the ide or nerfling (*Idus miniatus*), common bream (*Abramis brama*), fountain salmon (*Salvelinus fontinalis*), river char (*Salvelinus umbla*), salmon (*Salmo salar*), river trout (*Salmo fario*), rainbow trout (*Salmo irideus*), smelt (*Osmerus eperlanus*), crucian carp (*Carassius carassini*), *Coregonus maraena*, *Coregonus albula*, pike (*Esox lucius*), and eel (*Anguilla anguilla*).

The introduction of the bream was attended with great success. *Coregonus maraena* and river trout have also become acclimatised, although the latter are still relatively rare in the waters of Evois. The river-trout are incubated at the Experiment Station. Positive results have been obtained by stocking with perch, crucian carp, tench, rainbow trout, fountain salmon, and *Coregonus albula*, but all the nerflings, river char, salmon, and smelts, as well as *Micropterus salmoides*, have completely disappeared.

Because the common bream was introduced when adult, it has become acclimatised in nearly half the lakes and can be caught as plentifully as the indigenous perch, pike, and roach. As it is a very prolific fish, some of the fry have to be distroyed. The average live-weight of the eatable individuals never exceeds 600 gm. During the first summer, the fry usually, attain the length of 3 cm.; they seldom grow to 6 cm. Spawning takes place at the end of May, when the temperature of the water is 20° C.

The smelt is very common in the north, and can easily be introduced into many of the lakes. The introduction of the fry generally gives discouraging, and always uncertain results, owing to the lack of plankton without which these fish cannot live. During its first year the smelt attains the length of 20 cm. The number taken are from 6 to 10 % of the total catch. The average live-weight of a smelt is from 700-1000 gm. It spawns in the middle of October at a temperature of 4° C.

Coregonus albula is the largest and commonest fish of the great lakes of Finland. It did very badly, however, in the lakes at Evois, where it suffered from want of food, as it lives entirely on plankton Though over 51 million fry have been introduced into these lakes in the course of some years, only a thousand fish have since been caught. The individuals that survived grew well, they were 14 cm. long in the 2nd year, 27 cm. the 3rd, and 34 cm. the 7th.

Perca lucioperca did not prove so satisfactory, although it was induced to spawn every year, the eggs being deposited as a rule after June 15, when the temperature of the air was 20° C. (water temperature 14°-26° C.).

In the ponds, the fish grew to as much as 8-10 cm. during the first summer, but in the lakes they remained very small

Crucian carp only flourished in one lake (superficial area 7 hectares, depth 4 metres), which had been fertilised by retting flax; the fish caught annually weighed altogether 32 kg.

Eels spread everywhere after they were first introduced, and could frequently be caught but they were all very small. The average weight of all the eels caught in one year is about 250 gm., although occasionally it is as much as 700 gm

The roach is the commonest of the indigenous species. At first it represented 70 % of the total number of fish caught, and it is still taken oftener than any other. The average weight of the individuals caught is 25-50 gm.

The perch also remains small. Average live-weight at first 31 gm.; later, 39-55 gm. This fish spawns as soon as the ice melts, when the temperature of the water is about 5° C. The common pike caught weighed 500 gm. on an average. In order to facilitate the introduction of new species of fish, many pike as well as roach, were taken. Though the number of roach in the Evois lakes were thus much diminished, the pike still always represented as before over 20 %, and sometimes even 30 % of the total catch. This fish spawns soon after the melting of the ice.

PRODUCTION OF THE LAKES. — The average production of all the lakes during the 25 years of experiment was 3.69 kg. per hectare, and varied during the different years between 1.65 kg. (1894) and 6.52 kg. (1915). The average production of the various lakes was most irregular, being highest where flax was retted, for the vegetable matter introduced into

[1153]

the water caused a richer fauna to develop. Thus Kaitalampi (surface 2.72 hectares, depth 4 m.) had only produced 3 kg. since 1896 until the last few years, when fish caught weighed, respectively, 14, 15, 20, 70, and 24 kg. The average production of Valkea-Mustajärvis was 15 kg. in 1900, 14.5 kg. in 1901, and 31.5 in 1902, whereas the large lake, Alimäinen Rautjärvis, (superficial area 52 hectares, depth 10 metres), through which run the effluents of all the other lakes, only yielded an average of 2.56 kg.

CONCLUSIONS. — From what has been said, it appears that the introduction of new species of fish into such barren waters is practically useless.

The remarkable increase produced in the number of fish by retting flax in the lakes confirms the satisfactory results obtained by ZEHMEN, STRUCK, etc., who manured the water with fermented plants.

Where the application of fertilisers does not seem likely to have a lasting effect upon the margin of the lake, it may perhaps be possible, by their use, to obtain a regular increase of the fish supply in waters that are deficient in mineral salts.

1154 - The Effect of Food Conditions Upon the Intensity of Parasitic Infestation in Fish.

— DEMOLL, in the *Allgemeine Fischerei-Zeitung* Year XLVI, No. 12, pp. 136-140. Munich, June 1921.

Prof. WOHLGEMUTH, of the Hofer Institute at Wielenbach, carried out experiments in 1920-1921, with a view to determining whether any great difference would be observable in the spring in the health, mortality, and parasitic infestation of carp that had been well supplied with food during the winter, and of those that had been provided with nothing to eat. He also wished to discover whether under unsatisfactory food conditions certain species of parasites disappear.

The carp forming the subjects of the experiment were divided between two wintering tanks of equal size and character, in such a way that whereas one lot had plenty of food at its disposal, the other larger lot was obliged to pass the winter fasting.

POND No. 43.

Stocked with 100 *Fish of one Summer.* (5 individuals examined).

Carp. No.	1 Blood	2 Epidermis	3 Branchiae	4 Intestines	5 Kidneys	6 Remarks
1	—	—	*Sanguinicola inermis* eggs. All encysted.	*Eimeria* in small numbers.	*Sanguinicola inermis*, encysted eggs.	Condition fair.
2	—	—	Isolated individuals of *Dactylogyrus*.	*Eimeria* in considerable numbers.	—	Condition fair.
3	—	—	*Sanguinicola inermis*, fairly numerous. *Gyrodactylus* isolated individuals.	*Eimeria* in considerable numbers.	*Sanguinicola*, encysted eggs.	Very thin.
4	—	—	*Sanguinicola inermis* some encysted eggs.	*Eimeria* numerous.	—	Condition fair.
5	—	—	—	*Eimeria* very numerous	—	Condition fair.

POND NO 44

Stocked with 9190 *Fish of One Summer.* (5 individuals examined).

Carp No	1 Blood	2 Epidermis	3 Branchiae	4 Intestines	5 Kidneys	6 Remarks
		Dactylogyrus isolated individuals.	*Dactylogyrus* in considerable numbers *Gyrodactylus*, some encysted eggs of *sanguinicola inermis*	*Eimeria* in large numbers		Very weakly specimen
2	—	*Cyclochaeta* (isolated) *Saprolegniae* *Gyrodactylus* in moderate numbers.	*Cyclochaeta Dactylogyrus* and *Gyrodactylus* in fairly large numbers. *Sanguinicola* encysted eggs	*Eimeria* in large numbers		Condition fair Beginning to be infested with *Saprolegniae*
		Cyclochaeta. *Gyrodactylus*	Sanguinicola eggs not encysted, *Cyclochaeta*, *Gyrodactylus* all fairly numerous	*Eimeria* in large numbers		Condition fair Beginning to be infested with *Saprolegniae.*
		Cyclochaeta *Dactylogyrus* *Gyrodactylus* Eggs of *Dactylogyrus* ?	*Sanguinicola* encysted eggs *Dactylogyrus* *Gyrodactylus*	*Eimeria* numerous	—	Very thin, at the point of death Already dead
		Cyclochaeta *Dactylogyrus*	*Cyclochaeta* *Dactylogyrus*	—	—	Slightly decomposed, very thin

The fish selected were carp of one summer, and infested with parasites Before they were introduced into the winter tanks they were examined with the result that *Piscicola, Dactylogyrus, Cyclochaete,* and *Chilodon* were discovered on their branchiae and epidermis *Eimeria* in their intestines, and *Trypanoplasma* in their blood In October, 1920, two trout ponds, (Nos. 43 and 44), each of 100 sq. m were stocked with 1 year old carp 6 to 8 cm. long; 100 fish being put into the first pond, and 9190 into the second

On April 19, 1921, fishing was begun in the two ponds No 43, which had been stocked with 100 carp, still contained 56 (56 %), whereas No. 44 into which 9190 carp had been introduced, only contained 1003 specimens (11 %).

As soon as the fish were removed from the water, they were at once examined The annexed tables give the results of this examination.

It was found that the live weight of specimens from the more densely stocked wintering pond was slightly greater than those from pond 43. Only 1 out of 10 individuals had however survived, in every case, owing to rigorous natural selection, the largest and strongest fish had always been preserved, which explains why the live weight of the carp left in the thickly populated pond was higher than that of the pond into which fewer fish has been introduced so that the struggle for life had been much less acute, and therefore even the less vigorous specimens had managed to survive This fact is the more important seeing that the condition of the best specimens of the 9190 summer carp was much worse than that of the fish of the other lot

From a comparison of the lists of the autumn and spring parasites, it would appear that one series had completely disappeared ; this may however be due to the life-history of these pests. In any case, no very important conclusions could be drawn from a comparison of the results of the autumn and spring examination.

As regards parasitic infestation at the end of the winter, the data afforded by the two series of experiments are of great interest.

In the case of all the survivors of the 9190 fish, the epidermis proved without exception to be infested with *Dactylogyrus* and *Gyrodactylus*, and in 4 out of the 5 specimens examined, *Cyclochaeta* was also present, whereas none of the other lot of carp was similarly attacked. As *Gyrodactylus* and *Dactylogyrus* were found on the branchiae of both lots, but on the epidermis solely of badly nourished individuals, it may be concluded that overcrowding (facility of contagion) is not the cause of parasitic infestation. The epidermis is only attacked when the fish is badly diseased or badly nourished, even though the parasites may be already present in large numbers on the branchiae.

Although it is possible that the invasion of the epidermis may be due not to want of resistance but to the emigration of parasites from the over-crowded branchiae, these experiments prove in any case that good nutritive conditions have an influence upon parasitic infestation.

1155 - **Artificial Fertilisation and Incubation of the Shad.** — PIROLA, E., in the *Bollettino della Società Lombarda per la Pesca e l'Acquicoltura*, Vol. XIV, No. 8-9, pp. 81-87 8 figs Milan, August-September, 1921.

The shad is a marine fish with migratory habits; one form known as the Twaite shad (*Alosa finta*) to distinguish it from the Allice shad (*A. vulgaris*), has adapted itself to fresh water conditions. It has a finer flavour than the marine type, and the most tasty specimens come from the Lake of Como.

The author decided to carry out experiments on the artificial fertilisation and incubation of this fish, as scientific literature contained only vague information respecting its reproductive processes, although BOWERS (Washington) had treated the question at length as regards the American shad (*A. sapidissima*), a much larger form with very different habits living in brackish water in North America.

The author's experiments, which he describes in detail, had very satisfactory results. In a few days, he was able to put into the water some 500 000 fry of *A. finta*. The incubators were the same as those used for *Coregonus* with slight modifications. Fertilisation was effected dry.

The incubation tank was kept supplied by water heated electrically to 20° C.

FARM ENGINEERING

1156 - Decree of the French Minister of Agriculture Dated June 17, 1921, Respecting Enterprises for Mechanical Ploughing. — *Journal officiel de la République française*, Year LIII, No 163, pp 7009-7010 Paris, June 19, 1921

Article 1. — Contractors who undertake mechanical ploughing for others and are using more than 2 machines, or sets of total power of at least 200 H P. may receive assistance from the State

Should the petitioner be at the same time a threshing contractor, the H.P. required by the threshing apparatus may be deducted from the minimum H.P. prescribed for mechanical ploughing apparatus or sets, provided that the total power of the said mechanical ploughing apparatus or sets is not below 100 H.P.

In exceptional cases machines for use in viticultural, horticultural, and kitchen-garden work shall be permitted to represent a total not exceeding 100 H.P., but they shall be not less than 10 in number.

Article 2. — All requests must be addressed, on Jan. 15 each year at the latest, to the Minister of Agriculture, who will acknowledge their receipt.

Article 3. — The assistance given by the State consists of premiums calculated on the basis indicated by the decree of March 31 and includes the additional premium provided for co-operative societies. The premiums are only for the mechanical ploughing apparatus or sets, threshing plants being excluded. These premiums are placed at the disposal of the interested parties in the following manner:—

(*a*) One half at the date when the demand is approved,

(*b*) the remainder in amounts of ¼ at a time, at the end of each of the first two agricultural seasons, and on production of the proofs required by article 4.

In case of accident, the beneficiaries shall be required to replace the destroyed apparatus or sets, and shall request, in the case of new purchases, a premium the amount of which shall be fixed after taking into account the sums already paid by the State and the amount of insurance-money already received.

Article 4. — The proofs of the areas to be ploughed shall consist in the production of the summary and detailed statement for the Commune showing the extent of the arable land, and giving the names of the farmer working them, and the sums paid by the latter for the work performed. These said statements after having been certified as correct by the Mayors, shall be sent every year not later than August 15 to the Directors of the Agricultural Services of the one or more Departments where the work is being done, who after due verification as required, shall forward the said documents, with their remarks, to the Minister of Agriculture.

Article 5. — Should one of the conditions of the agreement not have been fulfilled at the end of the first season, or should an incorrect return knowingly have been made, the half of the premium already paid shall be refunded to the Treasury by order of the Minister of Agriculture.

If one of the above-mentioned conditions remains unfulfilled at the end of the following seasons, the portion of the premium corresponding to the sum mentioned in par. *b* of Art. 3 shall not be paid.

Article 6. — Farmers who desire to benefit from the premiums provided in the present Decree, must submit to all the measures of control and verification prescribed by the Minister of Agriculture.

1157 - **Agricultural Machinery in Spain.** — *The Engineer*, Vol. CXXII, No 3424 p. 163. London, August 12, 1921

Reports received in the Department of Overseas Trade from the Commercial Secretary to his Majesty's Embassy at Madrid with regard to openings for machinery in Spain state that, although Spain is primarily an agricultural country, the Spanish farmer has not kept pace with the times. The most antiquated methods are still employed. Grain continues to be cut by scythes and threshed by trampling while wooden hand ploughs are in common use. The change which is inevitably taking place is retarded by ignorance and prejudice. An innovation in one district is slow to react in the next. In short, the opening in Spain for agricultural machinery is wide, but new business often involves educating the buyer first. The tariff on these goods has been recently raised 50 per cent.

The tractor has not yet established itself definitely in Spain, and the various exhibitions which have been held in the past year or so have not had much apparent success. The public interest has been small and the sales of machines through the exhibitions are said to have been disappointing. The chief advantage of these shows seems to lie in the extensive Press notice they have received. The market for tractors is more for the future than the immediate present, though the time is opportune for manufacturers to lay the foundations of business by making their machines known.

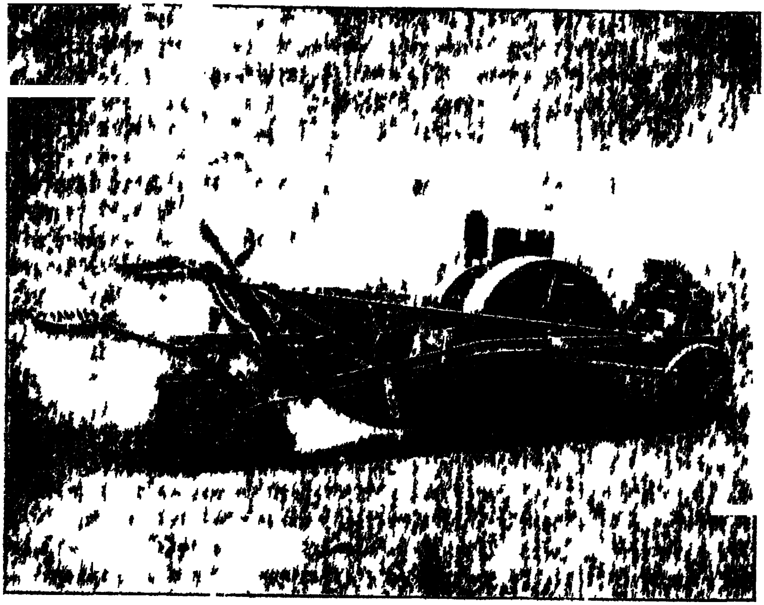
Winnowing and cleaning machinery is made in Spain, though there is certainly a margin for popularising the use of modern machines of which, it is suggested, the British manufacturers might take advantage, if able to compete in price. Milling machinery is partly imported and partly manufactured in the country. The demand for wine and cider presses is largely supplied by local production, but there seems to be an opening in the Vigo district. Drilling and threshing machines are not much used. On the other hand, there is a growing foreign trade in small motors for agricultural use. In this the Swiss and Germans are keen competitors.

In the Barcelona district water turbines are likely to be largely required for the numerous power plants which are being put up all over the country. At present this trade is almost wholly in the hands of Swiss and German manufacturers, but it remains to be seen what effect on this demand will follow the Royal Decree of June 14th, obliging future holders of water power concessions to use Spanish machinery whenever possible. Centrifugal pumps are also largely required for irrigation purposes. Light cheap pumps and motors are at present supplied by American, German, Norwegian and Swiss makers.

In the carpentering and cabinetmaking industries much work is done by hand which could with advantage be done by machinery The manufacture of all sorts of house furniture has developed considerably of late years and a large export trade has been established But in order to introduce the machinery manufacturers must either send travellers who are able to explain the advantages of their machines, or they must appoint agents with security in their appointment for a number of years It is stated that propaganda confined to the sending of catalogues will lead to business

1158 – **The "Maskell Junior Motor Plough".** — *The Implement and Machinery Review*, Vol 46, No 549, p 1401 London, January 1, 1921

The Maskell Junior Motor Plough is specially designed to meet the needs of those who require a smaller outfit than a tractor and a multiple furrow plough, and also those whose system of cultivation demands that operations be conducted in the minimum of space and with the greatest possible economy of the headlands



"Maskell Junior Motor Plough"

This machine will plough a furrow 6 to 9 in deep and 9 to 12 in wide under ordinary conditions and the adjustments for width and depth are made easily. It is a self-contained single-furrow machine with an over all length of 12 ft, a width of 4 ft. 3 in, a height of 3 ft 6 in, and a weight of 10 cwt Steering may be either by handles as the operator walks behind, — a preferable arrangement in difficult working conditions, —

or from a detachable driver's seat. The machine can be swung round on its driving wheel, and the same lever which raises or lowers the plough is used to adjust the depth of ploughing as the work proceeds.The outfit is balanced on one large driving wheel, and is supported by an idler wheel on the left side, which acts as a slight drag and gives the plough a tendency to run to the left. This idler wheel is adjustable vertically to run in or out of the furrow. Power is supplied by a fan cooled V twin cylinder BLACKBOURN engine giving 10 h. p. on the brake, on petrol. The drive is transmitted to the multiple disc clutch by a chain and by gears from the clutch to the single driving wheel. A pulley drive is supplied for such power work as is consistent with the size of the engine. Cultivating and other tools can be had, while the outfit is made self-steering by a furrow guide wheel.

Manufacturers: MASKELL MOTOR PLOUGH Co. Advance Works, Jews Row, Wandsworth, London, S. W. 19.

1159 - **The Beaters of Threshing Machines.** — CASTELLI, M., in *Il Villaggio ed i Campi*, Year XLVI, No. 23, p. 2. Rome, June 4, 1921.

The innovations introduced of recent years into the construction of threshing-machines have related chiefly to the details of transmission and mounting, or to improvements in various accessories (automatic feeder, bagger, straw elevator, etc.). and therefore to the reduction of labour. The essential structure of the thresher has remained unchanged since certain types became fixed; each country having a preference for the model it makes itself.

Except in the case of special forms used for paddy, forage, etc., beaters are always of two kinds, being furnished with either teeth, or bars. The former type is preferred by the American makers, and the latter by the European.

The toothed beater does the work mere quickly, but less perfectly, whereas the bar beater works more slowly, but injures the grain and straw less. The first kind is especially suited to America, where the threshing is done on the field at harvest time, or immediately after, and the large output of the machine is what matters most; the second is more adapted to the North of Europe, where the sheaves are stacked, often under cover, and the threshing is done by very few workers at a time when, owing to the season or the condition of the crops, there is nothing requiring attention on the farm.

The author has studied these two types of beater, in order to decide which is the more suited to agriculture in Italy, where the conditions more nearly resemble those obtaining in America, than those of Northern Europe. He examined the capacity and qualities of the beaters from the following points of view:—

1) Method of feeding (lengthwise, that is to say the end of the sheaf is inserted first; or crosswise, the sheaves being put in parallel to the axis of the beater, so that the ears are placed alternately right and

left), and hence the possibility of using an automatic feeder, straw-stacker, etc.

2) Breaking the straw.

3) Efficiency in separating the grain, and the effect of the speed and of the regulation of the distance between the beater and the concave.

4) Rupture or integrity of the grain.

5) Wear and tear and life of the machine, repairs.

6) The production, and therefore dimensions of the machine.

7) Power required.

A toothed beater can only be fed lengthwise but a bar-beater can be fed lengthwise and cross-wise, provided that the length of the beater is not less than that of the straw. This method of feeding is the rule for bar-beaters, for thus the greatest advantage can be obtained from the character of the beater, whereas if the sheaves are not inserted lengthwise although some of the special advantages of this type are secured, the chief are lost.

In the case of short straw and clean wheat, provided the machine is sufficiently wide, the cross-wise fed bar-beater has many advantages (regularity, saving of fatigue to the man feeding, adaptability to automatic feeders of simple construction, little broken straw, excellent working of straw-shaker, bagger, and elevator). These good points certainly outweigh its defects (small output, requires more power, deficient speed and regularity). When however as often happens in Italy, the straw is long, full of weeds, and of a variety that is difficult to thresh, and further where the threshing operations take place on sloping ground, where the necessary narrowness of the threshing machines precludes all question of cross-wise feeding, the superiority of the bar-beater begins to become more doubtful. Therefore in order to make a satisfactory choice, a number of other circumstances have to be taken into consideration.

Apart from the breaking of the straw (though sometimes this is desirable) the loss of grain by incomplete separation or through breakage are very important matters

The grain is detached by shock, repercussion or as the result of friction ; thus the first type of beater is much more susceptible to variations in speed than the second, and only works well within very narrow speed limits. BALASSA (*Die Dreschmachinen*) gives 29 to 32 m. per second as the peripheral speed of bar beaters, and from 14 m. (small machines) to 20 m. (large machines) for toothed beaters In large American threshers of modern construction, the peripheral speed of the beater is as much as 32 m. per second, but the author has found 10 m. per second quite sufficient, at all events for very dry sheaves and dry straw. With the bar beater, variations in speed result in rupturing the grains, or preventing their complete separation. The same occurs with the toothed beater, but to a less extent, so that practically, unless the speed is reduced beyond the minima given, the only effect of lessening the speed is a decrease in the output.

On the other hand, whereas it is possible to alter the output of the bar beater any way for the time being by increasing or decreasing the distance between it and the concave, this method of regulating the action is much less efficacious in the case of the toothed beater unless the teeth are conical or angular, which seldom occurs.

It is alleged that the beater with teeth breaks the grain too much, and sometimes lets ears pass intact; there is something to be said on both these counts, but as honey-comb sieves are in general use for the mechanical sorting of the grain to serve as seed-corn, the first objection is of little weight, and the ears that escape threshing are very few in number unless only the tip of the sheaf is presented, for example by an automatic feeder, and in such cases as in that of the American threshers, it is necessary to have an elevator for the ears that are refused by the sieve, and return them to the beater. If, however, the feeding is done by hand, and the shears held *slightly obliquely*, no loss of whole ears is possible.

It must be added that the bad repute into which the toothed beater has fallen is also due to the use of antiquated types, with few rows of teeth made of unsuitable material, or unpractical shapes (conical or angular), and badly affixed to the bars, thus easily injuring the grain.

A rapid, toothed beater of the modern American type with about 300 teeth per linear metre (the teeth being arranged in 20 rows), working against a concave with 6 rows of teeth, gives perhaps double the hourly output of a bar beater of the same length but fed cross wise. This however depends little upon the dimensions of the machine which is always subordinate to the size of the sieves and shakers, though a beater 0.50 m.-0.60 m. shorter than the internal width of the frame may facilitate the use of an electric motor or internal-combustion engine carried by the threshing-machine.

Finally the moderately rapid toothed beater requires less power, and less regular working, which is of a certain importance when the beater is driven by electricity, or in the case of hand or horse-driven threshing machines.

After having examined the points in favour of both types of beater, the author comes to the conclusion that the superiority of the form with bars must be admitted when it is a question of cross-wise feeding (the length of the beater being not less than the height of the sheaves), whereas the toothed beater is to be preferred, when only lengthwise feeding is possible, or if it is desired to have a large output, and economise motive power, provided a little less regularity is no objection; for in this way, the work of the motor is lightened in the types of motor-thresher machines with internal combustion engines or electric motors, which are becoming increasingly common and tend to take the place of those driven by steam-engines.

1160 – **Machines for Treating Cotton Seed Against the Pink Boll-Worm.** — GHESQUIÈRE, A. I. (*Entomologist of the Belgian Congo*), in the *Annales de Gembloux*, Year 17, Part 7, pp. 234-238. Brussels, July 1921.

It has now been proved that the pink boll-worm (*Platyedra* [*Pectinophora*] *gossypiella*) passes the winter (the dry season) in a resting condition on the bolls that are left on the plants or have dropped to the ground at picking time, or else on the stored cotton seed.

In a pamphlet entitled " Machines for the Treatment of Cotton Seed against Pink Bollworm " (*Gelechia gossypiella* Saund.), Ministry of Agriculture, Egypt, 1917, the entomologist, G. STOREY, gives the history of the control measures adopted by the Egyptian Government since 1909, and describes the machines (giving their advantages and defects) which were made until the end of 1917 for the purpose of disinfecting the seeds of the cotton plant.

In addition to the campaigns undertaken against the boll-worm, with the hope of inducing cotton-growers to collect and burn the dead capsules, so as to reduce the danger of invasion in the following year, the Egyptian Ministry of Agriculture carried out a very complete series of experiments in order to discover the best way of killing the Bollworm larvae without injuring the seed.

The results of these experiments were published in the *Agricultural Journal of Egypt*, 1913, Vol. III, Part. II, by GOUGH and STOREY (" Methods for the Destruction of the Pink Bollworm in Cotton Seed ").

The conclusions were as follows :— Three different methods of destroying the larvae of the pest have been found efficacious and commercially practicable, viz. :—

I. — Hot air treatment ;
II. — Poison gas treatment :
III. — Immersion in a 1 % solution with a carbolic base (" Cyllin ")

Methods I and II can be applied on a large scale at all times and Method III is suitable before sowing ; once the seeds are put into sacks, nothing further can be done

Two machines were constructed, one using hot-air, and the other carbon disulphide. Both were exhibited at a meeting of planters, factory owners, and cotton merchants.

A report was published in the *Agricultural Journal of Egypt*, Vol. IV, Part II, STOREY : " Note on Large Scale Experiment against the Pink Bollworm of Cotton Seed. "

In spite of its efforts, the Ministry of Agriculture met with general apathy on the part of all persons interested, and in some cases, had to face actual opposition, many objections being raised against the machines, which were considered of too clumsy construction, and too cumbrous by some, while others feared the seed would be injured by the high temperatures employed, or objected to the poisonous and inflammable gases used.

The Entomological Section directed its whole attention to the hot-air treatment, and in order to encourage initiative, the Egyptian Government passed two laws about Dec. 15, 1916, the one obliging all cotton factories to treat their seed for the season 1917-1918 by means of a machine approved by the Ministry of Agriculture, while the other prohibited any cotton, whether seed or ginned, from being kept in the warehouse after May 1, except in the case of specially licensed warehouses, viz., those that had been disinfected and were so constructed that the moths could not find their way in, and lay their eggs on the seed.

Within a few months numerous machines were made in Egypt, England, and America and by the end of 1917, they could be classed as follows:

I. **Fumigating machines using** (*a*) **carbon disulphide,** (*b*) **hydrocyanic acid.**
II. **Hot air machines** (*a*) **using a current of hot air;** (*b*) **acting by radiction,** (*c*) **by direct contact with heated metal plates.**

This last type includes: — 1) the SIMON machine, definitively approved by the Egyptian Ministry of Agriculture, and made by MASSERI, CURRIEL and Co, 16, Sharia Nubar pasha, Cairo; 2) the MACRI machine, also approved by the Ministry: made by the Society for the exploitation of the Delta Zefta machine.

From the latest information received (Oct. 1920) from the Director of Belgian Agriculture, the British Cotton Growing Association considers that the question of the disinfection of cotton seed is solved by the use of the Simon machine.

1161 - **Utilisation of Waste Farm Products for Fuel.** — *Indian Engineering*, Vol. LXIX, No. 26, p. 362. Calcutta, June 25, 1921.

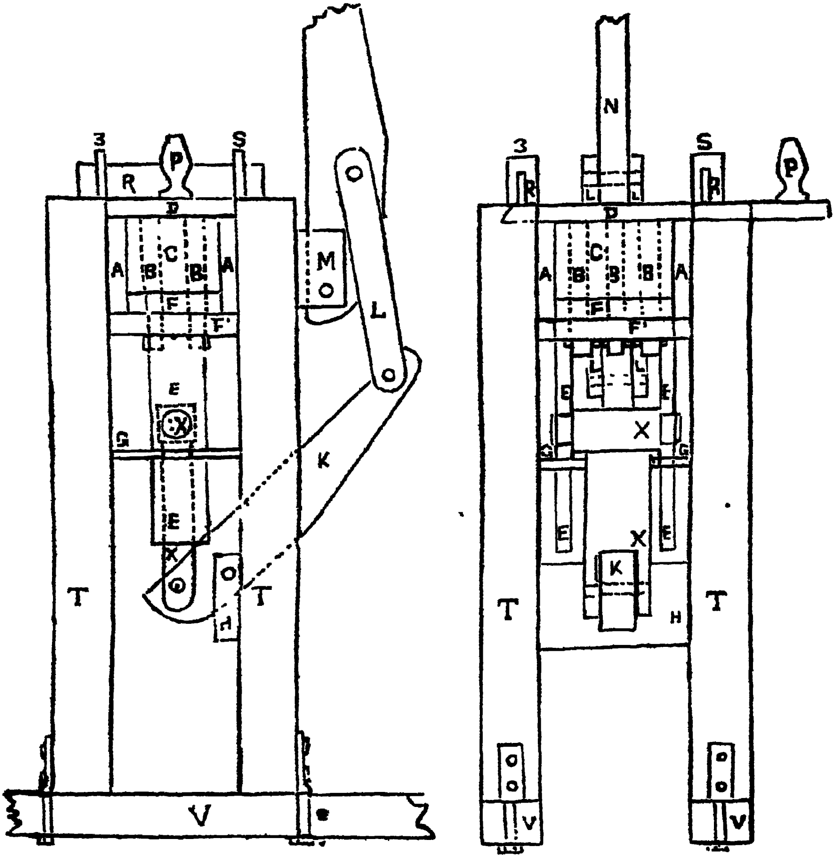
Waste farm products have been very successfully used mixed with coal-dust, in manufacturing briquettes for fuel. Such waste products as saw-dust, dead leaves, paper, wheat and coal husk, etc., are usually employed, mixed with clay as a binder and pressed in a suitable press. The mixture consists of 10 to 12 per cent. of coal or coke dust, and 15 to 20 per cent. of waste products and fat clay soil. When paper is used, it is first soaked for some days in water and the glutinous content in size acts as a binder. The following is a brief description of the press used in the manufacture of the briquettes:—

A chamber *C*, supported on four posts *T*, and made to receive the mixture for pressing, is traversed by vertical rods *B*, fastened on to a ***fixed*** plate *F*, which are employed for perforating the briquettes. A ***mobile*** plate *F'*, pierced with holes to let through the rods can be pushed from below upwards by the levers *K* and *N*, through two uprights *E*, guided by grooves *G*, and a connecting rod *X*. A cover *D* closes the top of the chamber *C* and is held solid by clamps *R* which are held in slots *S* bored in iron plates.

The method of working is simple: The mobile plate *F'* is lowered to the bottom of the chamber by raising the lever *N*. The cover *D* is drawn off by the handle *P*. The chamber is filled, the cover replaced and the lever *N* is forced down. Then the cover *D* is removed and, to free the briquette from the rods which have made the perforatione, the lever *N* is lowered to the ground. It remains only to lift off the briquette, by sliding it carefully, and setting to dry.

Pressure is exerted by means of two levers *K* and *N* connected by two connecting rods *L*. The lever *K* acts directly on the rod *X*. The lever *N* acts on the lever *K*. If the arms of the lever *K* are in the ratio

1 : 4 and those of the lever *N* in the ratio 1 : 7, the rod *X* receives a force equal to 4 × 7 = 28 times the force exerted at the end of the lever *N*. If a man weighing 75 kg. hangs on to the end of the lever *N*, the matter enclosed in the chamber will undergo a pressure of 75 × 28 = 2100 kg. a pressure which may be increased by lengthening the lever *N*.



Briquette Press, vertical Sections.

The measurements of the briquettes are 0.22 metre × 0.18 metre × 0.07 metre. When dry they have a mean weight of 3.5 kg. if made with coal dust.

The press is easily made with hard rough sawn wood and bolts. There is no fitting and little iron work. Thus the farm staff which looks after the cart repairs could make it. Moreover any hands which have not been discharged at the beginning of winter can be set to making briquettes when not otherwise employed.

1162 - **Paraffin from Vegetable Oil as a Motor Fuel.** — See No. 1169 of this *Review*

RURAL ECONOMICS

1163 - **Agricultural Costs and Sale Prices in Belgium before and after the War.** — RASQUIN, M., in the *Journal de la Société Nationale des Agriculteurs de Belgique*, Year III No 35, pp. 275-276. Brussels, Aug. 27, 1921.

The author sets out in the following tables the costs of cultivation and the sale price of agricultural products before and after the war.

AGRICULTURAL COSTS (in francs per quintal).

		Before the war	at the end of 1920
I — *Fertilisers and foodstuffs:* —			
Nitrate of soda		20	120
Sulphate of ammonia		24	135
Superphosphate		5	30
Basic slag		5	25
Kainite		4	13
Wool refuse		5	20
Linseed cake		20	90
Groundnut cake		18	95
Coconut cake		18	85
Maize		15	75
Bran		13	50
II. — *Machinery and implements:* —			
Plough		110	500
Reaper		900	4800
Mower		350	1800
Carts		1000	4000
Wagons		500	2200
Sacks		1	6
Shoeing		4	20
Wheel barrows		30	180
III. — *Salaries and wages:* —			
Driver (board and lodging)	annual	600	4000
Cowman (board and lodging)	»	500	3000
Servant (board and lodging)	»	360	1500
Journeymen	daily	5	17
Beet tilling	»	50	200
Beet pulling	»	60	250
Reaping	»	70	200
Threshing	per sack	1	6

SALE PRICES OF AGRICULTURAL PRODUCTS (in francs per quintal).

	Before the war	At the end of 1920
Wheat	19	90
Rye	20	80
White Barley	20	90
Oats	20	88
Hay	6	30
Straw	4	12
Sugar beets	3	16
Potatoes	8	35
Mangels	1.50	7.50
Butter (per kg.)	5	17

AVERAGE PRICES OF LIVE STOCK (in francs per head)

	Before the war	At the end of 1920
Horses	1200	6000
Cattle	650	1600
Milch Cows	550	2800
Sheep for grazing	30	180
Young pigs (two months old)	30	186

Before the war a young farmer about to start reqnired for the equipment of his farm in dead (including all agricultural machinery) and live stock a fixed sum of 1000 francs per hectare of his farm.

At the present time stocking a farm requires a capital of at least 3000 francs per hectare. Thus a farmer taking over a 100 hectare farm would incur initial capital charges of about 300 000 francs.

1164 - **Cost of Production of Wheat in a Commune in Romagna (Italy) during the Agricultural Year 1919-1920.** - SBROZZI D., in *L'Italia Agricola*, Year 58, No. 8, pp. 225-237. Piacenza, Aug. 15, 1921.

The author analyses the cost of production, in the agricultural year 1919-1920, for wheat grown on a 60 hectare farm in a commune in Romagna, the average yield being about 15 quintals per hectare. The year was unfavourable, because the high spring rainfall laid the crops and was the cause of much rust. The wheat followed a leguminous crop, a bean crop or a wheat crop, for the soil was improved and suited to a second crop. Ploughing was done by tractors of the CASALI cable machine type. Ploughing, manuring and cultivation were carried out intelligently and carefully. The varieties cultivated were Carlotta Strampelli, Gentil rosso and Shiriff Cologna. The author gives for the different headings of expenditure the unit price for each year from 1914 to 1920. Those only which relate to the first and the last of the series are reproduced here.

In 1887 the results of an enquiry by the Ministry of Agriculture over 244 farms producing 15 hectolitres par hectare shewed that the cost of production of wheat was 9.80 lire per hectolitre, not including rent, or 15.87 lire when the latter was also taken into account.

At the end of the last century Professors RAINERI and JEMINA stated that the cost of production of wheat in intensive culture following

COMPARISON BETWEEN PRICES AND SALARIES IN 1914 AND 1920

		In 1914		In 1920	
Price of 1 quintal of coal	lire	4.50		85	
1 quintal of wood	»	3	(1915)	18	(1919)
1 quintal of petrol including delivery	»	125	(1918)	260	(1920)
Salary and compensation: —					
for woodcutting per hour	»	0.25		2.50	
		p. hour	p. hectare	p. hour	p. hectare
for the mechanic	»	0.45	1.35	2.40	6.75
for each labourer	»	0.30	1.05	2.40	6.00
for water carriers, per day	»	1.50		10.00	
Salary per hour for working in the wheat field: —					
Digging and transplanting in October	»	0.37		2.75	
Digging and transplanting from November to February	»	0.35		2.46	
Hoeing, female labour	»	0.226		1.91	
Weeding	»	0.17		1.57	
Cost per unit of fertiliser: —					
Phosphoric anhydride (superphosphate.	»	0.416		3.00	
Nitrogen (nitrate)	»	2.00		15.00	
Cost of threshing: —					
Price of wheat per quintal	»	26		100	
Premium for the threshing machine	%	3.50		6	
Daily cost of harvesting (10 hour day).	lire	5.50		37	
Harvest contract price per hectare	»	33		232.50	
Cost of the threshing machine per quintal	»	1.26		6	
Labour per quintal	»	1.00		6.75	
Carriage per quintal	»	0.10		0.65	
Transport, per quintal	»	—		1.60	
Wages of the machine team per 100 quintals of wheat: —					
Mechanic	»	3.58		26.42	
Chauffeur	»	5.45		17.33	
4 « paglierini » (Labourers for feeding the threshing machine)	»	3.57		16.45 (1)	
Carter	»	5.75		20.00	
« Ministro »	»	3.57		16.45	
« Provveditore »	»	4.46		17.00	
Interest on machine capital	%	3.50		6.00	
Food for mechanics (2)	lire	7.00		45.00	

(1) With a minimum guaranteed output of 200 quintals a day.

(2) Divided equally between the mechanic, chauffeur and the "paglierini".

on meadow clover could be reduced, according to the value of the clover, to 10.34 lire, 8.5 lire and even 6.54 lire per hectare. Professor POGGI, however, does not take this view and considers that the cost should be placed much higher.

COST OF WHEAT CULTIVATION PER HECTARE.

CREDIT

Wheat: 15 quintals at 99.50 lire (the nominal price being 100 lire per quintal and a deduction made for loss occurring between the threshing and delivery to the Requisition Commission, and receipt stamps)	1492.50	*lire*
Straw: 15 quintals at 9 *lire*	135.00	»
Straw for litter	105.00	»
Chaff	10.00	»
Total	1742.50	»

DEBIT

Ploughing	240.00	*lire*
Harrowing and pricking out	66.00	»
Sowing	30.00	»
Maintenance of ditches	100.80	»
Manure	110.00	»
Seed: 120 kg. at 84 *lire*	100.00	»
Hoeing and weeding	200.00	»
Harvesting	232.50	»
Transport and stacking	65.00	
Threshing	198.00	
Transport and delivery	57.00	»
Insurance: lire 2.83 × 15	42.45	»
Dues and taxes	28.35	»
Expenses of administration	50.00	»
Interest on floating capital (1520 lire at 6 %)	45.60	»
Interest on sunk capital	150.00	»
Nutritive material removed by the crop	439.50	»
Total	2155.10	*lire*

Net loss 2155.10 *lire* — 1742.50 *lire* = 412.60 *lire* per hectare.

From a series of comparative tables that have been drawn up on the subject of the cost of commodities, we reproduce the following, compiled by G. MARINELLI, *La Terra*, vol. IV: *Italia* (Publisher: Vallardi) which represents the number of hours that have to be worked by a labourer to give him a salary equal to the price of 1 quintal of wheat.

In 1862	195 hours	In 1893	86 hours
» 1867	203 »	» 1905	80 »
» 1871	163 »	» 1914	80 »
» 1881	122 »	» 1920	21 »

1165 - Respective Costs of Production of Green Forage and Silage Crops in Nebraska. (U. S.). — See No. 1026 of *Review* Oct. 1921.

AGRICULTURAL INDUSTRIES

1166 - Wines Made from Grapes Infected with *Eudemis* — HUGUES, E. (Chef de travaux à la Station oenologique de Montpellier), in the *Annales des Falsifications et des Fraudes*, Year XIV, No. 151, pp. 139-141. Paris, May 1921.

On one of the estates in the South of France, where the last crop had been imperilled at the time of the vintage by the attacks of cochylis and eudemis, the author gathered 2 lots of grapes at the same time from an Aramon vine. One lot had been punctured and much injured by these insects, whereas the other had hardly been touched.

As soon as these grapes were gathered, they were at once pressed, and a rapid examination of the musts obtained gave the results set forth in the following Table:—

TABLE I. — *Analysis of musts of sound grapes and of grapes infected with Eudemis.*

		Grapes must	
		Sound	Infected
Reducing sugar expressed as glucose . . .	gm. per litre	175.00	225.00
Total acidity expressed as H_2SO_4	» » »	5.48	11.10
Volatile acids	» » »	0.10	0.3
Alcohol by volume.	. . %	nil.	0.3°
Colour	. %	Colourless	Distinctly red

It was found, as has been recorded many times before, that the must of eudemis-infected grapes is much sweeter and has a far higher acid content than that of sound grapes. On the other hand analysis revealed the presence of 0.3° of alcohol, and 0.3 gm. per litre of volatile acid in the must of the diseased grapes, whereas the must from the sound fruit contained no alcohol, and a very small quantity of volatile acid. Thus before the grapes were picked, fermentation had already set up in the infected berries.

The two musts were fermented separately. When tunned, the amounts of wine and of pomace obtained were respectively as follows:— Wine (*vin de goutte* and pressed wine), per kg. of grapes 712.5 c.c. in the case of the sound grapes, and 647.5 c.c. in that of the infected grapes: promace per kg. of grapes, 125 gm. from the sound grapes, and 215 gm. from the diseased grapes. Thus the amount of wine obtained from eudemis-infected fruit is considerably less.

It may be supposed that as the grape, when attacked by the insects, had already developed all its tissues, the subsequent changes would be limited to an increase in the sugar content and a decrease in acidity. It would therefore appear that the pomace might furnish a measure of the weight which a given weight of diseased grapes would have attained if they had been healthy. Now, if 125 gm. of pressed pomace correspond to 1 kg. of sound grapes, 215 gm. correspond to 1.720 kg. According to this hypothesis, the loss that can be attributed to the attacks of the insect would be about 42 % of the crop.

On the other hand it was found that the must from the eudemis-infected grapes contained more sugar, and more acid than the product of normal grapes, and the wine had a higher alcohol and acid content. If however, the calculation is made for 1.72 kg. of sound grapes, instead of for 1 kg. of diseased grapes, the sugar content is lower, and the acidity higher (1).

An analysis made in February showed the results given in Table II. These show that whereas the composition of wine made from sound grapes was normal, the product of the infected grapes had a high alcohol content, and an excess of acidity; further, the dry extract was very strong, and possessed a peculiar, bitter taste. In addition, there was much free tartaric acid present, and the saccharimetric deviation was distinctly positive; this last abnormality is probably due to the presence of dextriniform substances.

TABLE II. — *Analyses of Sound Wine and of Eudemis-Infected Wine.*

		Wine from sound grapes	Wine from infected grapes
Alcohol	% in volume	10.3°	12.0°
Dry extract at 100°C.	gm. per litre	20.50	52.75
Ash	» » »	2 25	2.10
Alkalinity of ash expressed as potassium car-		1.48	1.72
bonate	» » »	4.04	4.70
Alkalinity of ash expressed as cream of tartar	»	4.75	11.94
Fixed acidity	»	3.92	11.06
Volatile acidity	»	0.83	0.88
Reducing sugar expressed as glucose	»	0.80	3 85
Saccharimetric deviation	»	0	+ 4
Total potash	»	3.98	3.08
Total tartaric acid	» » »	4.43	6.98
Free tartaric acid	» » »	0.34	3.12
Taste		Good, clean	Sharp, bitter
Total alcohol + total acidity		15.05	24 04
Total alcohol + fixed acidity		14.22	23.16
Ratio alcohol : extract		4.00	1.9
HALPHEN ratio		0.44	0.97
BLAREZ ratio		2.62	1.09
ROOS ratio		3.05	12.1

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(1) See also: J. DUGAST, Vins anormaux, *Annales des Falsifications et des Fraudes* year 1917, p. 21. (*Ed.*)

It would thus seem that the effect of the attacks of the insects is to suppress, or at all events to hinder, the processes that usually take place towards the close of the ripening of the fruit, that is to say, the increase in sugar content, the diminution in acidity, and the transformation of the free tartaric acid, either by combination, or combustion.

1167 – **Non-Alcoholic Wines and Ciders** (1). — *La Cidrerie française*, Year 33, No. 6, pp 173-177. Paris, August 1921.

The President of the General Syndicate of Ciders and Fruits for Cider-Making of France made enquiries respecting the manufacture of non-alcoholic ciders and received the following note from the French Commercial Office for Switzerland

NOTE ON THE MANUFACTURE OF NON-ALCOHOLIC WINES AND CIDERS IN SWITZERLAND. — In order to obtain a non-alcoholic cider of good quality, it is necessary to mix apples of various kinds (sour and sweet), for the flavour depends upon the cider containing sugar, tannin, and acids in certain proportions. The apples should be chosen by an expert, for the kind of fruit selected determines the quality and clarity of the juice extracted. If sweet and acid apples are mixed in the right proportions, the juice expressed should be relatively clear and not require filtering.

Fruits of different kinds are not mixed as a rule, the apple juice being the extract of apples without any admixture of pears or other fruit.

The apples or grapes should be ripe, but not over-ripe. In no case is fruit used that is not sufficiently mature for the table. Should they be dusty or covered with soil, they may be washed, but if clean this is optional.

To extract the juice, the fruit is first pounded in stone mortars, and the pomace thus obtained extracted by a hydraulic press. It is of the greatest importance that, during pressing and the subsequent operations, the juice should never come into contact with iron, which imports a disagreeable taste. Iron utensils ought therefore never to be used.

Pomace is not tunned before pressing ; in fact, all the operations must be carried out rapidly so that the juice will not remain too long in contact with the air, which might start fermentation.

The hydraulic presses used in most of the Swiss factories are supplied by Messrs. RAUSCHENBACH of Schaffhausen (Switzerland).

As soon as the juice leaves the hydraulic press, it passes through a pipe to a metal sterilising apparatus filled with water at a temperature of 66° C. to 70° C. The juice, which is in a spiral aluminium tube, remains in the steriliser for half-an-hour at most, after which the operation is complete. It should be noted that, after this stage, the juice should never come into contact with the air.

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(1) As regards the manufacture of alcohol-free ciders and wines, the pamphlet by M. LEUTHOLD, of Waedenswil (Zurich), and sold by him at the price of 0.75 Swiss francs, may also be consulted. M. A. BÖHI's (Bürglen, Thurgau) brochure also gives useful information concerning the manufacture of alcohol-free sparkling wines and champagne. It is sold by Messr. HUBER and Co., Frauenfeld at the price of 1.60 Swiss francs.

After sterilisation, the cider or wine is taken into receptacles holding 15 to 20 hectolitres from which all the air has previously been expelled. In these it remains for some weeks or even months before being bottled. The receptacles are provided with a fermentation indicator consisting of a black fluid contained in a glass spiral in the form of a horizontally-placed S, which turns white as soon as the fermentation begins.

Before bottling, the juice is filtered through asbestos and can be filtered several times if necessary, in order to render it perfectly clear, but it is better only to filter it once, for the repetition of the process affects the taste of the liquid. Asbestos filters are well-known, and their use is not a trade secret. They are made in Switzerland by Messrs. TH. SEITZ at Kreuznach-am-Rhein, and Messrs. HOENY, Mechanische Werkstätte at Ober Meilen.

The bottles used for alcohol-free wine or cider are not sterilised before being filled, but are very carefully washed. It should be noticed that the success of the preparation largely depends upon the scrupulous cleanliness of all the apparatus and bottles used.

The bottles, when filled with juice, are placed open in a metal vat provided with a cover. The vat is then filled with water at about 70° C, the water coming up as far as the necks of the bottles. Sterilisation is complete at the end of about half-an-hour. The bottles should be corked at once, to prevent the juice cooling. Metallic caps fitted inside with a ring of cork, are generally used in mechanical corking. This process appears the surest and most economical. It is necessary for the bottles to be hermetically closed in order to prevent any subsequent fermentation of the juice.

In making alcohol-free champagne or sparkling wines the same process is employed up to and including the bottling. Before sterilisation, the bottled juice is subjected to carbon dioxide under pressure of 2 to 6 atmospheres. This pressure varies according to the temperature of the wines, and the nature of the product required. It should be 2 atmospheres in the case of sparkling wines and 6 or 7 in that of champagne. A lemonade apparatus is generally used for introducing the carbon dioxide into the bottles, which should be made to withstand the pressure.

The corking operation is the same as for ordinary champagne bottles, the cork stopper being wired on. Sterilisation is effected later in the autoclave; the pressure in the interior of the apparatus must be increased progressively as the temperature rises, in such a manner that the external pressure balances the pressure inside the bottles. This is a very delicate stage of the manufacture, as the bottles easily explode. The bottles are then laid down in a cool place.

The pomace is as a rule used for the making of preserves, or for distillation. It is not dried, but is employed in its natural condition.

The " Alkoholfreie Weine und Conservenfabrik Meilen A.-G. ", at Meilen, made apple-honey for some years, but has since given up doing so. This product is obtained by merely evaporating the juice in the open air in a jacketed apparatus similar in shape to a kind of retort, that is always to be found in jam factories.

In the manufacture of alcohol-free wines and ciders, and also in that of apple-honey, no foreign substance (such as glycerin for instance), is ever introduced to promote coagulation.

The temperature of the work-rooms is not of special importance, for the operations must be performed as quickly as possible.

As regards the utilisation of the by-products, it appears from the experience of the Swiss factory, that all that can be done is to use them for distillation, or sell them to preserve factories. Generally, a preserve and jam factory is annexed to the alcohol-free wine factory.

The process described has not been patented, but patent machines are used, which can be procured, on application to the Firms whose addresses are given in this abstract.

1168 – **Yeasts From the " Sura " of the Coco-Palm** (1). — De Mello, F. (École de médecine de Nova Goa, Portuguese India), in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIV, No. 11. pp. 584-586. Paris, March 19, 1921.

In Portuguese India, the name " sura " is given to the juice extracted from the spathe of the palm-tree which is also called in other places " toddy ", calloo, and arack. " Sura " supplies alcohol, vinegar, and a kind of sugar known as " jagra. "

Assisted by one of his students, M. F. Fernandes, the author isolated (by inoculating agar containing 4 % of glucose in Petri dishes) 17 cultures of yeasts capable of fermenting glucose, laevulose and mango juice but not galactose, lactose, and saccharose. The author has classified these yeasts as follows:— Genus *Saccharomyces* Meyen 1838 emend Vuill.: *S. surae* I sp. n.; *S. surae* II sp. n.; *S. toddyi* sp. n. Genus *Saccharomycodes* Hansen 1904: *S. palmarum* sp. n.; Genus *Atelosaccharomyces* of Bourm. and Goug 1909; *A. loyolinus* sp. n.; Genus *Zymonema* of Bourm. and Goug 1909; *Z. insulare* sp. n.

1169 – **Preparation of Paraffins from Vegetable Oil.** — Mailhe, A, in the *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 6, pp. 358-359. Paris, August 8, 1921.

Fatty oils cannot be distilled under ordinary pressure without to some extent decomposing. The author thought it would be possible to decompose them more completely if they were placed in contact with mixed dehydrating and dehydrogenating catalysts at temperatures varying from 550° C. to 650° C. For this purpose, use can well be made of electrolytic copper, associated with magnesia, alumina or kaolin. The mixture is made into balls with the help of an agglutinant, and the balls are heated in a copper tube. Linseed oil is introduced by means of a capillary tube into one of the ends of this tube. The vapours in passing through the mass of the catalyst, give rise to two classes of products, the one liquid and easily condensed, the other gaseous and capable of being collected in a gasometer.

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(1) Regarding the fermentation products of palm sap, see *R* May 1915, No 546 and *R*. June 1921, No. 672. (*Ed.*)

The experiments described by the author show that the decomposition of linseed oil, using a copper-magnesia catalyst followed by hydrogenating the most volatile products with nickel, gives rise to aromatic carbohydrates. The fat chain has been cyclicised, and as the cyclic products thus obtained are free from sulphur, cyclohexane and its derivatives can be obtained.

It is evident that by this catalytic process, it is possible by starting with a vegetable oil, to obtain a volatile oil and an inflammable paraffin of a mixed character that can be used as motor fuel. Specific gravity of the volatile oil at 23° C., 0.7607; specific gravity of the paraffin at 21° C., 0.8644. They are both soluble in any proportions in alcohol.

1170 - **The Oxyhydridase of Milk.** — ALOY, J. and VALDIGNIE, in the *Comptes rendus des Séances de la Société de Biologie.* — Vol. LXXXV, No. 26, pp. 333-334. Paris, July 16, 1921.

The milk ferment discovered by SCHARDINGER that decolorises methyl-blue in the presence of formaldehyde, belongs to the class of ferments possessing both oxidising and hydrogenating properties, which are known as oxyhydridases. The authors isolated this ferment from milk by saturating it with powdered sodium chloride; leaving it to stand for 12 hours, then filtering it and finally precipitating the filtrate by a semi-saturated solution of ammonium sulphate.

The oxyhydridase thus separated gives the reactions of protein substances; it is insoluble in water, soluble in solutions of neutral salts, and precipitated from these solutions by acetic acid. It contains a considerable amount of phosphorus and iron and is thus a phospho-proteid.

1171 - **Géromé or Gérardmer Cheese.** — BLIN, H., in *L'Alimentation moderne et les Industries annexes,* Year XIX, New Series, No. 16, pp. 231-232. Paris, July 1921.

Cheese-making in the mountainous district of the Vosges is an industry dating back to very remote times. The earliest mention of the Géromé cheese was in 1070. The cheese-makers of the Remiremont district in the valley of Cleurie and Vagney have taken advantage of the syndical system to introduce considerable improvements into the manufacture of Géromé cheese, which has a formidable rival in Munster cheese.

In the Vosges the cows yield rich milk, of which the average composition, according to VACCA, is as follows: — Casein 3.14 %; albumen 1.19; fats 3.13; lactose 4.20; salts 0.72; water 87.62.

Géromé is manufactured in the Cantons of Gérardmer, Thillot, Saulxures, Fraize, and Remiremont. Taking one year with another, the total production is estimated at about 7 million kg., of a value of 5 600 000 fcs.

This cheese is prepared in the following manner: —

PRESSING. — As soon as the milk has been drawn from the cow, it is strained, and heated in a 50-litre copper caldron to 36° C. The caldron is provided with a wooden cover having, in the centre, a hole that can be closed at will by means of a disk rotating on a pivot. In factories where modern methods are adopted, the milk is curdled by liquid, unadulterable and constant preparations of rennet (commercial rennet).

In many places however the rennet is made from the fourth stomach of a calf, organs being selected which have reddish veins, and adhere to a slightly moistened finger. The stomachs are washed, inflated, placed to dry, and afterwards cut up (into quarters or thirds), and put in a bottle filled with water to which has been added a little salt, and a pinch of pepper. The bottle is corked, and after 3 to 4 days the rennet is ready for use. Two spoonfuls of rennet must be used for 50 litres of milk. The room temperature is kept at from 15° to 18° C.

CUTTING AND MOULDING THE CURD. — When the milk has coagulated, the curd is cut with a ladle made of tin or copper and shaped like an elongated shell with the two broader faces slightly compressed. The basin is covered again, and when coagulation is quite finished, that is to say from 1 ½ to 2 hours after the addition of the rennet, the whey is separated from the curd with a strainer of the same shape as the ladle, but a little larger (30 cm. × 17 cm. and 5 to 6 cm. deep).

The whey collected in the strainer is removed with the ladle, and the curd is again divided to facilitate drainage. The curd is placed into cylindrical forms or moulds of deal, 35 to 40 cm. high, and 15 to 18 cm. in diameter. Lower moulds are employed for cheeses that have already acquired a certain consistency without however being completely drained. One part is perforated with holes, the other which is not perforated, fits over it. When, after about 12 hours, the thickness of the curd is reduced by one half, the rack is removed and the cheese turned out into a dry mould. This process is repeated twice a day for 2 or 3 days.

SALTING, DRYING AND RIPENING. — Three or four days later, if the cheese is sufficiently firm, it is turned out on a board of beech wood sprinkled over lightly with salt. On this it is rolled, the operation being repeated on 3 or 4 consecutive days. From 30 to 35 gm. of salt are required for each kg. of cheese.

The cheeses should be washed over carefully with a cloth dipped in slightly salted water, and then turned, and this must be done for several days. As soon as they are firm, they are removed to the drier, which consists of superimposed shelves placed in a closed but well-ventilated, room. In summer, they are dried in the air, in boxes with wooden bottoms, the upper part being shaped like a roof and draped with muslin to keep off the flies. As sown as the skin is formed, and the body is hard, the cheeses are put to ripen in the cellar, which should be dry with openings to the north and south. The cheeses are frequently washed with tepid water containing a little salt, and turned. When they become brick-red, and the paste gives when pressed with the finger, they are ripe and ready for market. In order to produce a good cheese, continual attention is necessary for not less than 2 months. The largest cheeses take 3-4 months to ripen.

CHARACTERS OF GOOD GÉROMÉ. — This cheese should be rich inside, firm, and with few cavities. Badly-made Géromé cheeses break, crumble and are full of holes.

It takes 7.5 to 8 litres of milk to make 1 kg. of cheese, and a good Vosges cow will give enough milk annually for 260 kg. of cheese. Géromé cheeses are made of very different weights and dimensions, varying from 500 gm. to several kg. The small sizes sell quickest. They are packed for the market in small round, deal boxes.

1172 - **Bacteriological Investigation of Some Pork Butchers' Products** (1). — BORNAND, M., in the *Travaux de Chimie alimentaire et d'hygiene*, Vol. XII, Parts 3-4, pp. 119-125. Berne, 1921.

The author has studied the bacterial flora of several of the products of the pork-butcher, viz., 11 Bologna sausages, 2 "atriaux" (2), and 9 Vienna sausages, obtained in the market at Lausanne.

In all, he found a larger or smaller number of living bacteria. *Bacterium coli* was met with in 77.3 % of the cases, and *Bacterium proteus* in 27.3 %.

The above mentioned micro-organisms can cause poisoning and generally find their way into the sausages through want of cleanliness, the instruments that have been used for opening the intestines usually being employed for cutting up the meat. It is therefore of paramount importance that the hygienic conditions under which sausages, etc. are made should be under careful supervision.

1173 - **Oil From the Feet of Oxen and Sheep.** — BRUNO, A., in the *Annales des Falsifications et des Fraudes*, Year XIV, No. 151, pp. 137-139. Paris, May 1921.

Oil from the feet of oxen can be defined as oil extracted by prolonged decoction (10-12 hours) from the metacarpal and metatarsal bones of adult animals. As the extraction is repeated several times, and the bones treated are those running from the hoof to the knee or hock, the resulting substance is a bone-marrow fat which is for the most part liquid at ordinary temperature. In warm weather, however, a fair amount of stearopten is rapidly deposited, and in winter, the fat quickly assumes the consistency of an ointment. Ox-foot oil is much used as a lubricant on account of its "oiliness."

The oil floating on the surface of the water in which the bones are cooked is removed with a large spoon, and purified by re-heating with water, followed by careful decantation. According, to the temperature at which decantation is carried out, the oil may be entirely fluid, or contain a larger or smaller quantity of dissolved or solid substances; it differs also in character according to the animal, and the date of its slaughter. Thus ox-foot oil cannot be expected to have a constant composition.

The author having had occasion to make some of this oil, sent a pure, authentic sample to the Central Laboratory for the Prevention of Adulteration (*Laboratoire Central de la Répression des Fraudes*), where it was analysed by M. ROUILLARD. For purposes of comparison, sheeps-foot oil was also made and forwarded for analysis. The results obtained are given in the following Table.

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(1) See *R.* Nov.-Dec. 1920, No. 1180. (*Ed.*)

(2) The name "atriaux" is given in the Canton of Vaud (Switzerland) to flat sausages containing chiefly chopped pork liver. (*Ed.*)

Analyses of Ox-foot and Sheeps-Foot Oil.

	Filtered sheeps-foot oil		Filtered ox-foot oil	
	at 15° C.	at 45° C.	at 15° C.	at 45° C.
Specific gravity at 15°C.	0.917	—	0.9169	—
Iodine index	84	82	75.3	74
Oleo-refractometer dev. at 22°.	+ 2.2	+ 2.2	— 2	— 2
Refractive index	1.46805	1.46805	1.4675	1.4675
Saponification index	194	194	197	197
Free fatty acid, as oleic acid	0.34	0.34	0.67	0.67
BELLIER resorcin test — Upper layer	pale pink	—	pale pink	—
BELLIER resorcin test — Lower layer	pale yellow	—	pale yellow	—

These two oils deviated from the customary zero when tested in AMAGAT and JEAN's refractometer, though this zero would have been registered if they had been mixed.

According to the author, ox-foot oil could be prepared from the terminal phalanges (after removal of the hoof) as well as from the metacarpus and metatarsus, though it would appear that little advantage would thus be gained in the case of the ox, and practically none with the sheep.

The by-products of this industry are the osselets which are of small value, and the cannon bones which are much used in the brush and the fancy turnery trades.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1174 - **"Bramble-Leaf" ("Roncet") of the Vine Reported from Tripolitania** (1). — Felicioni, C., in *L'Agricoltura Coloniale*, Year XV, No. 10, pp 507-508, 1 plate. Florence, October 1, 1921.

With the development of vine-growing in the Italian colony of Tripolitania, a very severe form of rachitic disease with a course and symptoms very similar to those observed in typical " bramble-leaf " (" Roncet ") of the vine (*Vitis rupestris*) has made its appearance.

The disease seems to have been introduced in cuttings imported from Tunisia, and used for planting most of the Tripolitan vineyards.

Vines growing on their own roots are as much attacked as grafted stocks. The disease appears on one-year-old plants about July, or during the second period of growth, and causes the vine to produce a large number of small, finely dentated leaves; the internodes being frequently stunted and swollen, and the foliage covered with pale-coloured patches. These symptoms are particularly noticeable in the case of adult vines. Scars and dead patches occur also along the edges of the leaves especially at points where the dew collects, and flows. No alteration can be detected on the exterior of the roots and rootlets, which also do not appear to be affected by rot, although some broom-like malformations occur, and the cortical tissue becomes dark.

Mention should be made of the effect caused by the nature of the soil upon the gravity of the disease. Vines growing on the alluvial soil of Wudiâm are much more seriously attacked than others planted in sandy soils. In the author's opinion, this may be because the stiff clayey-sand forming the sub-soil does not allow the water to drain away, and hinders the proper aeration of the strata into which the deep roots penetrate.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

1175 - **Control of Plant Parasites of the Walnut in France.** — See No. 1123 of this *Review*.

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(1) See also: *R.* July 1914, No. 684; *R.* Sept. 1916, No. 1029; *R.* August 1918, No. 873; *R.* Mar. 1919, No. 392; *R.* Oct.-Dec. 1919, No. 1260. (*Ed.*)

1176 - **"Record" Variety of Oats Resistant to Rust.** — See No. 1111 of this *Review*.

1177 - ***Sclerospora Sacchari*, the Sugar Cane Mildew in the Philippines.** — LEE, H A., and MEDALLA M G., in *Science*, New Series, Vol. LIV, No 1395, p. 271-275. Lancaster, Pa, Sept. 23, 1921.

In the beginning of 1920, a firm of Japanese sugar cane growers introduced cane points for use on their plantations in Rizal Province, Luzon, which they stated had been grown by the Experiment Station of the Japanese Government in Formosa.

In April 1921, the cane having been ratooned, numerous cases of etilation of the young plants were observed. Such plants were very conspiuous and could be observed at a considerable distance from the field. On the lower surface of the affected leaves a white spore mass was abundant. Microscopic examination showed as was expected the presence of *Sclerospora Sacchari* T. Miyaki. The mildew was missing in the fields of native cane adjacent to and surrounding the field of Formosan cane, which confirmed the suspicion that the fungus had been introduced from Formosa into the Philippines.

Measures have been taken to completely exterminate this disease by repeated ploughing of the affected field, burning the affected stubble and allowing the land to lie fallow. Steps to trace seed cane that emanated from the field are also in progress and it is probable that the disease will be entirely eradicated.

1178 - ***Erysiphe Poligoni* and *Sclerotinia Libertiana* Injurious to the Soya Bean in Baden, Germany.** — See No 1191 of this *Review*.

1179 ***Phytophthora* sp. and *Septoria Lycopersici* on Tomato Seedlings, in New South Wales.** — DARNELL-SMITH, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt 8. p 577 Sydney, Aug. 1921.

Tomato seedlings in certain districts in New South Wales were attacked last year by blight (*Phytophthora* sp.) and leaf spot (*Septoria Olycopersici*.

The part attacked is generally some portion of the stem in the majority of cases at or near the ground level. The seedlings fall over and wilt.

S. Lycopersici is recognised by pale or ochre coloured spots on which are produced numerous minute black bodies which contain the spores. Affected leaves have a tendency to curl.

The following control measures are recommended by the author :— 1) Remove and burn all diseased plants; 2) Spray the rest with Bordeaux mixture; should wet weather prevail, other sprayings may be necessary at intervals of about 10 days; 3) Avoid keeping the seed-bed too moist; 4) Water the soil rather than the plants; 5) Shelter the beds with some impervious material during damp weather.

1180 - *Physalospora Miyabeana* n. sp. and its Conidial Form (*Gleosporium*) Injurious to *Salix purpurea* var. *angustifolia* in Japan. — FUKUSHI, T., in *Annals of the Phytopathological Society of Japan*, Vol. 1, No. 1, pp. 1-11, figs. 8. Nishigahara, Tokio, July 1921.

In the early autumn of 1919 a number of diseased Japanese willows (*Salix purpurea* var. *angustifolia*) were observed near Sapporo. A preliminary examination of these specimens revealed the constant association of two forms of fungi, *Physalospora* and *Gleosporium* with the lesions. Since some species of *Physalospora* are known to possess a *Gleosporium* as their conidial stage, it may be supposed that a possible connection exists between these two fungus forms; this assumption has been verified by a number of cultural experiments.

The following autumn the disease reappeared in the same nursery. A *Gleosporium* was isolated from the affected leaves and stems of the *Salix* and the spores thus obtained were inoculated on healthy plants with positive results.

A more careful study of the symptoms of disease as well as the nature of the causal fungus has led to the conclusion that the disease is due to a hitherto undescribed species of *Physalospora*, and its conidial stage (*Gleosporium*).

It is highly probable that this disease has been prevalent for many years in several willow plantations in Hokkaido, since certain basket makers have notified an outbreak at Kotoni, Barato, Urashinotsu and Shinshinotsu in the province of Ishikari. According to one basket maker the disease has been prevalent at Kotoni for the last 7 years and in certain districts such as Motomura near Sapporo, willow cultivation has been abandoned owing to the severity of the trouble The affected branches are said to be liable to break at the lesions giving baskets of inferior quality on account of the brownish spots visible after the bark has been peleed off.

During the autumn of 1920, another type of willow canker disease, probably due to a fungus parasite belonging to the genus *Marssonina*, made its appearance in several willow plantations in the vicinity of Sapporo, and also in the Nursery where the first mentioned disease had been notified. According to the basket maker the second disease is less injurious to the willow than the first.

The disease caused by *Phys. Miyabeana* and its conidial form (*Gleosporium*) appears on the stems as well as on the leaves and chiefly on the upper part of the plant. The lesions on the stem are whitish-grey or grey in colour and elliptical in shape, varying from 5 to 30 mm. in length. Often the lesions become united involving a considerable portion of the stem or extending so widely as to completely surround it. The base of the petioles is often attacked, but the points of infection are by no means confined to this portion. The lesion is usually surrounded by a blackish border line with a considerably sunken central area, where minute black pustules are found in clusters which are conspicuous owing to the contrast in colour with the surrounding tissues. Later the lesion may become cracked and finally uncovered exposing the woody tissue by the peeling of the dead bark.

The indications of the disease on the leaves are dark brown spots on the upper surface. The spots are circular or outlined irregularly, measuring 2 to 5 × 3 to 7 mm., and often showing concentric marking. When the lesion involves the midrib, a considerable portion of it may be blackened lengthways.

The symptoms of the other disease probably due to *Marssonina* are quite distinct. The disease is characterised by elliptical tar-black lesions on the stem and black punctures on the leaf. The lesions on the stem are not sunken and the pustules are somewhat scarce and indistinct.

1181 - **Vesicular Rust of Weymouth Pine Caused by *Cronartium ribicola* in Switzerland.** — See No. 1193 of this *Review*

WEEDS AND PARASITIC FLOWERING PLANTS.

1182 - ***Amaranthus deflexus* and *Xanthium Commune*, Newly Recorded Weeds in New South Wales.** — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Pt. 8, p. 580 Sydney, Aug. 1921

At a meeting of the Linnean Society of New South Wales on May 25, 1921, W. F. BLAKELY exhibited two weeds hitherto not recorded for the State : *Amaranthus deflexus* L. and *Xanthium commune* Britt.

A. deflexus L (" low amaranth ") is common along the railway line between Cowan and Hawkesbury River. The plant is widespread throughout Europe and appears as a weed in other parts of the world. It has the general appearance of *A. macrocarpus* Benth., a native species from which it differs in certain characteristics of flowers and fruits. In 1920 the same plant was recorded in Victoria.

X. commune (" Common cockleburr" of America), has recently been forwarded from Ebenezer. On investigation, two other specimens of this Composita were found at Cattai, near Windsor (1915) and near Dunedoo (1918) and identified as *X. Strumarium*, thus indicating that this obnoxious weed is spreading unnoticed. *X. commune* is similar in habit to *X. Strumarium*, but is readily distinguished by its characteristic fruits. It is apparently new for the Commonwealth.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1183 - **Some Insect Pests of Cultivated Crops in British Guiana.** — BODKIN, G E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. XIV, No. 2, pp. 132-139. Georgetown, April 1921.

In British Guiana, the insects most injurious to sugar cane, the principal cultivated crop, are those known collectively as " borers " which consist of 3 species of lepidopterous larvae, namely *Castnia licus* Fab. ("giant moth borer ") (1), *Diatraea saccharalis* Fab. (small moth borer) (1) and *D. canella* Hamps. (2), very similar to the preceding species in all its stages of development.

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(1) See *R.* Jan. 1911, No. 353 ; *R.* Feb. 1912, Nos. 439-440 ; *R.* May 1919, No. 671. (*Ed.*)

These three insects pass their larval and pupal periods within the cane itself, thus causing weakening of the plant and material deterioration in the juice Their attacks are often followed by a complete destruction by termites.

Twenty years ago *C. licus* appears to have been unknown in this Colony. Since its first appearance however, it has multiplied at an exceedingly rapid rate and during 1919 on 16 estates, 91 479 moths were destroyed, and 1 600 046 larvae. Like many other injurious insects in this part of Tropical America, *C. licus* has invaded the cultivated areas from the forest region.

Birds, especially the " kiskadee " (*Pitangus sulphuratus*) and old witch (*Crotophaga ani*) are the most important enemies of this insect.

On all sugar estates, organised gangs, chiefly composed of native born children (Creoles) are employed in the destruction of *C. licus* and have grown remarkable clever at this work. After sending them into a field of canes recently cut, the roots are searched for traces of the borers and wherever scarring or open boring is observed a long hooked wire is introduced into the stumps; if the larva is present it is soon dragged to the surface. If this is not successful, the stump is partially uprooted and the larva or chrysalis thus secured. The caterpillars and chrysalides are kept by each child in an old tin and at the end of the day the contents are carefully counted and checked. Children provided with nets are also employed to catch the adult moths.

To destroy *D. saccharalis* gangs of children are sent through the fields of young cane and wherever a dead central shoot is observed it is cut off close to the ground and the larva or chrysalis secured and placed in a tin. In both cases the children are paid for their work. Three hundred specimens are sometimes collected by one child in one day. Cutting out cannot be continued after the canes are 4 months old. In 1919 22 779 354 caterpillars and chrysalides were thus destroyed.

The collection of the eggs of this lepidopteron is now carried out on most estates by means of a small gang of specially trained children who are well paid.

Two species of egg parasites of *D. saccharalis* (one of them *Trichogramma minutum* Riley is well known) are commonly met with and extremely effective. Several species of external Hymenopterous parasites also occur, one Dipterous parasite and a fungous parasite (*Cordiceps* sp.). The larva of an Elaterid beetle also preys on the early stages of *D. saccharralis*.

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(1) See *R.* Aug-Oct. 1911, No 2557; *R.* Feb. 1912, Nos. 439-440; *R.* Feb. 1913. No. 128; *R.* May 1913, No. 514; *R.* Apr. 1914, p. 488; *R.* Oct. 1915, No. 1106; *R.* April, 1916, No. 479; *R.* Aug. 1918, No. 935. (*Ed.*)

(2) See *R.* Feb. 1912, No. 439. (*Ed*)

Other pests which attack the cane are: 1) the weevil borer (*Metamasius hemipterus*) (1) which at times damages the stools and rooting system of the cane; 2) larvae of 2 Noctuid moths, *Remigia repanda* (2) and *Laphygma frugiperda* (3), which sometimes cause complete defoliation. These are destroyed by collecting in buckets containing paraffin and water. They become most numerous on the advent of rains after prolonged drought; 3) Two species of termites occur frequently and destroy all canes which have previously been weakened by borer attacks; the nests are collected in sacks, taken out of the field and burnt; 4) one species of mealy bug occurs at times in large numbers beneath the leaf sheath and when large numbers are present they undoubtedly weaken the vitality of the cane; these insects are destroyed in damp weather by fungi; in dry weather they multiply rapidly and remain healthy; 5) two species of *Cercopidae* occur at times in small numbers, but the damage done is generally speaking negligible, owing to the careful destruction of weeds in the sugar cane plantations.

The chief insect enemy of the coconut palm is the larva of a lepidopteron known as *Brassolis sophorae* L. which at times defoliates nearly every palm in the district. As the nests are large and conspicuous in the palms it is an easy matter to send up a child to cut down these nests. A large locust in one particular area has recently developed a taste for the foliage of the coconut palm and from time to time does marked damage.

In 1917, British Guiana experienced an invasion of locusts coming from Venezuela; after a strenuous fight for 5 months, it was successfully eliminated. When rice is in the nurseries, prior to transplanting, the larvae of the moth *R. repanda* often cause injury by feeding on the young shoots. The caterpillars have been destroyed successfully by flooding. The larvae of *D. saccharalis* frequently attack the fully developed plant.

Scale insects at times prove troublesome to citrus trees.

Cacao is more liable to fungoid diseases.

1184 - *Micrococcus (Staphylococcus) acridicida* Attacking Grasshoppers in Greece.

— KUFFERATH H, in the *Annales de Gembloux*, Year XXVII, Part 8, pp. 253-257. Brussels, August 1921.

Towards the end of May, 1913, the grasshoppers in certain parts of Greece were found to be suffering from a disease causing them speedily to lose their voracious appetite and die in a short time. The author on examining some of the infected individuals (received in June) under a low power lens, found them to be covered, especially on the abdomen, with small, white tufts, which were found to consist exclusively of *Micrococcus*.

After having isolated the organism, the author obtained pure cultures of four very similar species, one of which, a new species described under the name of *M.* (*Staphylococcus*) *acridicida*, proved to be of much practical importance. In August, the author sent it together with the three others to Athens, where it was the subject of two series of experiments.

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(1) See *R* Mar. 1916, p. 35. (*Ed*)

(1) See *R.* Aug. 1914, No. 803, and *R.* Sept. 1914, No. 865 (*Ed.*)

(3) See *R.* Dec 1910, p 20; *R.* Sept 1913, No 1113; *R.* Sept. 1914, No. 865; *R.* April 1918, No. 495. (*Ed.*)

In the first, an emulsion of the fungus was introduced by inoculation between the second and third abdominal segment of the insects: death ensued within forty-eight hours. The second series of experiments consisted in spraying the vines with the emulsion, and feeding the grasshoppers on the leaves thus infected. The results obtained in both experiments were identical. These researches were interrupted by the war, but although incomplete, the experiments made in Greece would seem to prove that the ingestion as well as the inoculation, of this micrococcus, soon bring about the death of the grasshoppers.

Preliminary trials for the purpose of ascertaining the action of this coccus when ingested or inoculated into living insects (caterpillars of *Pieris rapae* and an adult specimen of *Locusta viridissima*) in Belgium have resulted in the death, after a variable number of days, of a considerable number of the infected insects and the discovery of the pathogenetic agent.

1185 - **Chalcididae Parasites of Coccids in Japan.** — NAKAYAMA, S., in *The Philippine Journal of Science*, Vol. XVIII, No. 1, pp. 97-100, pl 1. Manila 1921.

An enumeration of species in the subfamily *Aphelininae*, observed in various parts of Japan as coccid parasites.

1) *Ablerus perspeciosus* Girault, on *Aulacaspis pentagona* Targ.;
2) *Aphelinus fuscipennis* Howard, on *Aspidiotus perniciosus* Comst., and *Chionaspis* sp.;
3) *A. japonicus* Ashmead;
4) *A. mytilaspidis* Le Baron, on *Hemichionaspis aspidistrae* Sign.;
5) *Azotus capensis* Howard, on *Aul. pentagona*;
6) *Azotus chionaspidis* Howard, on *Chionaspis difficilis* Ckll. and on *Aul. pentagona*.
7) *Coccophagus lecanii* Fitch on *Ceroplastes rubens* Mask., *Phenacoccus pergandei* Ckll. and *Pulvinaria citricola* Kuw.;
8) *C. yoshidae* n. sp. on *Coccus hesperidum* L.,
9) *Perissopterus mexicanus* Howard on *Aul. pentagona*;
10) *Prospaltella aurantii* Howard, on *Asp. perniciosus*;
11) *P. berlesei* Howard, on *Aul. pentagona*;
12) *P. niigatae* n. sp. on *Aul. pentagona*;
13) *Archenomus orientalis* Silvestri, on *Aul. pentagona*;
14) *Casca chinensis* Howard. on *Chionaspis difficilis*.

1186 - **Natural Enemies of *Acanthopsyche junodi*, the Macrolepidopteron Injurious to *Acacia mollissima* in Natal, South Africa** (1). — SKAIFE, S. H., in *The South African Journal of Science*, Vol XVIII, Nos 3-4, pp 291-301, figs. 15. Johannesburg, July 1921.

After completing the work of G. C. HAINES up till now not reported, by personal observations taken in the plantations round Pietermaritzburg

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(1) See also *R.* Aug 1919, No. 1241. (*Ed.*)

(Natal), the author gives a Summary of the investigations made the natural enemies of *Acanthopsyche junodi* Heyl (" wattle bagworm "), the worst of the pests of the black wattle *Acacia mollissima*. HAINES and the author examined in all nearly 60 000 bagworms; the life history of the wattle bagworm has already been studied in detail by FULLER and HARDENBERG.

Large numbers of the newly-hatched larvae are destroyed before they have an opportunity of forming their bags.

HARDENBERG mentions several kinds of spider which act as predaceous enemies of larvae just hatched. These larvae are dispersed by the wind, birds and insects, and carried to places where they die of starvation owing to lack of suitable food. Those that survive and manage to construct their bags enjoy a certain account of immunity for a time, as they are small, inconspicuous and well protected from their minor enemies. Later, however, the bags are very conspicuous and numbers of the larvae fall a prey to birds and rats (*Muridae*).

According to HARDENBERG there are 8 different species of insects parasitic on *A. junodi* viz. two Ichneumons, one Chalcid, and five Tachinids, but none of these had been determined, nor were their habits studied in detail. The author has observed only two of these parasites viz., an Ichneumon, *Philopsyche abdominalis* Morley, and a Tachinid, *Carcelia evolans* Wied., and notes are made on their life history and biological characteristics. *C. evolans* is in its turn preyed upon by a minute chalcid so far undetermined.

The bagworm is attacked by several diseases amongst which that caused by *Isaria Psychidae* Pole Evans, takes the first place. The efficacy of this very virulent fungus as a check on *A. junodi* is somewhat impaired by the attacks of another fungus, *Melanospora parasitica*, which grows on *I. Psychidae* and partially or wholly inhibits the conidia formation of its host.

Another virulent and extremely destructive disease of the bagworm is according to experimental results said to be caused by a filterable virus.

There are other diseases of an obscure nature to which *A. junodi* is liable, and which destroy the larvae It is as yet uncertain if these diseases are caused by bacteria or are due to disturbances in the normal physiological functions, or to both.

Out of a total of 59 687 bagworms examined, just over 1 % were destroyed by birds and rats, 19 % by insect parasites, 16 % by fungus disease, and 17 % by other diseases, making a total of 53 % destroyed. Despite the enormous numbers killed by the above agencies, the figures show that a far greater mortality must take place in the younger stages, from September to March. HARDENBERG estimates that the majority of bagworms which reach maturity are males, there being an excess of males over females of about 25 %. This agrees with the author's observations. Of the 47 % surviving, only 21 % will be females; in other words, out of every 100 bagworms found in the plantations in March, only 21 females will reach sexual maturity. These females will deposit some 40 000 to 50 000 eggs which will hatch the following spring. Assuming no yearly increase on the part of the bagworms, these eggs will be reduced to 100 by March, i. e. only one quarter of 1 % of the larvae hatched survive the early perils of their life. Even if this early mortality is taken into account, about which very little is known, it is by far the most important of the factors in the natural control of *A. junodi.*

1187 - **Machines for the Treatment of Cotton Seed Against *Platyedra (Pectinophora) gossypiella.*** — See No. 1160 of this *Review*

1188 - **Control of Pests of the Walnut in France.** — See No. 1123 of this *Review.*

1189 - **The "Pirovano" Vine Hybrids Resistant to *Phylloxera* and other Fungoid Diseases in Italy.** — See No. 112- of this *Review*

1190 - ***Oncopera mitocera,* New Grass Pest in Queensland.** — DODD, A. P., in *Queensland Agricultural Journal,* Vol XVI, Pt 2, pp. 79 81 Brisbane, Aug 1921

During the drier months of 1920, viz. July to November, the farmers of the Atherton Tableland were seriously concerned at the ravages of a Macrolepidopteron caterpillar — afterwards identified as *Oncopera mitocera* Turner (fam. Hepialidae) — that threatened to destroy a great proportion of the pasture in certain areas.

This insect appears to be confined to North Queensland and possibly to the Cairns district. Early in 1911, F. B. DODD observed the moths flying very plentifully at dusk, on the edges of Evelyn Scrub, near Herberton. The first record of *O mitocera* as a pest, seems to be contained in a letter written by J. G. JONES of Ravenshoe on September 15, 1919. Nothing was heard of its occurrence round Yungaburra until August 1920 when the farmers suddenly noted the damage done by the pest. Probably the caterpillars had been there for several years, but never in such numbers as to attract attention. The moths have been noticed in considerable force at Kuranda and it is certain that larvae have been found in the scrubs around Babinda.

Thus, the species has been found in the Cairns district. at all heights from sea level to 3500 ft.

A description is given of the different stages of the insect, followed by details of its life history and habits.

The larvae remain hidden during the day at the bottom of a vertical tunnel specially constructed in the soil, and emerge at night to feed on grass blades. Apparently fresh leaves are not essential, as in the scrub the surface of the ground is bare of vegetation and no doubt in this case fallen leaves and vegetable matter are consumed.

It appears that the grass roots are not touched in any case, nor the underground roots. The grass apparently dies through the action of the caterpillar gnawing at the base of the roots from the surface.

There is no doubt that this species is a native of the scrubs where it may be still be found. With the clearing of land and planting with grass, conditions have been favourable to the development of this insect as a pest, and it apparently has not been followed by its natural enemies.

The principal area affected is in the immediate neighbourhood of Yungaburra, from Kulara in the north to Kureen in the south; in the older-established districts near Atherton and Kairi it has not made its appearance, and southward around Malanda, the caterpillars have not been found in the pastures, although abundant in the scrub. Another area infested, although not to the same extent, is situated eastward from Ravenshoe, on the higher land toward the Beatrice River, 3200 to 3500 ft. above sea level.

The pest occurs throughout these areas and almost every farm is more or less affected; the fields present a very ragged appearance instead of a luxuriant carpet of grass. The extent of damage caused by the pest is evident seeing that this occurs during the drier parts of the year when good grazing is most needed.

Certain spiders (*Attidae*) catch a few of the moths. No doubt nightjars destroy a large number, but in the open field of the Tableland, the absence of birds which might help materially to check the ravages of the pest is very marked.

Climatic conditions must be an important factor in the increase or decrease of these caterpillars, and heavy rain or an excessively wet season may restrict their numbers.

1191 - **Pests of Soya Beans Observed in Baden, Germany** (1). — VON WAHL, in the *Zeitschrift für Pflanzenkrankheiten*, Vol. XXXI, Parts 5-6, pp 194-196. Stuttgart, 1921.

A list of the pests observed during three years on some varieties of soya-bean at Augustenberg, Baden. So far only two fungi have been recorded: *Erysiphe Polygoni* DC., and *Sclerotinia Libertiana* Fuck. The young bean plants, which in the district studied come up from the end of April to the beginning of May, were severely attacked by *Arion hortensis* Fér., *Agriotes lineatus* L., *Melolantha vulgaris* F., *Agriolimax agrestis* L., *Porcellio* and *Oniscus* spp.

Towards the middle of May, *Phyllotreta nemorum* L., *Psylliodes chrysocephala* L., and *Sitones* sp. were seen on the soya beans..

After the end of June, *Thrips physopus* L., *T. longicollis* Uzel, *T. discolor* Hal (?), *T. major* Uzel, *T. Albopilosa* Uzel, *Aeolothrips fasciatus* L., *A. albocinctus* Hal., *Smymothrips biuncinata* Uzel, *Baliothrips dispar* Hal, *Lygus pratensis* Fall., *Siphonophora ulmariae* Schk., etc., all attacked the beans. At the end of July, 1916, *Tychea phaseoli* Pass. caused serious injury to some plants of soya.

In August in all three years, *Epitetranychus althaeae* Hanst. occurred in large numbers, and did much damage. *Arvicola arvalis* again proved a formidable enemy to the soya-bean, at Augustenberg, and perhaps mice also did some injury to this leguminosa in that neighbourhood.

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(1) See also *R.* July 1914, No. 690; *R.* April 1916, No. 463; *R.* July 1919, No. 654; *R.* Feb. 1919. No. 268; *R.* Jan. 1920, No. 138; *R.* July-Aug. 1920, No. 511. (*Ed.*)

1192 - ***Anthonomus cinctus* Reported in Orchards in Great Britain.** — HARWOOD, P., and C[HAMPION], G. C., in *The Entomologist's Monthly Magazine*, Series III, Vol. III, No 82, pp 226-227. London, Oct 1921.

A single sample of the weevil (*Anthonomus cinctus* Koll. [= *A. pyri* Boh. and *A. bituberculatus* Thoms.]) was captured in an orchard adjoining Darenth Wood (Kent). This Curculionidea has been found under the apple bark in conjunction with *A. pomorum* L. A subsequent visit to the same locality failed to produce any further specimens of *A. cinctus*, but it is probable that it will be found in other orchards in Kent in the near future

This insect may prove an undesirable addition to the British entomological list, if destructive in the larval state.

1193 - **Pests of the Weymouth Pine in Switzerland.** — BADOUX H., in the *Journal forestier suisse*, Year LXXII, No. 9. pp. 163-173, 1 plate. Berne, September 1921.

It was long supposed that the Weymouth Pine (*Pinus Strobus*) introduced into the Swiss foress had found a refuge from all pests.

In reality, however, this conifer is attacked in Switzerland by a number of animal and plant parasites.

Among the latter, the first deserving mention is *Cronartium ribicola* Dietr. (aecidial form: *Peridermium Strobi* Kleb.), the cause of "vesicular rust." This fungus seems to have made its first appearance in Switzerland on *P. Strobus* towards 1904; it was reported at this date as occurring in the plantations of the Commune of Locle, which consisted of trees imported from Germany. The parasite had however already existed for some time in Switzerland, especially in the Engadine, where it was observed, in 1895, on *Ribes petraeum*, by ED. FISHER, who at that very time suggested that the second host of the fungus was *P. Cembra*, as was proved to be the case actually in the Engadine, by G. SCHELLENBERG in 1903. Vesicular rust has of late years spread rapidly in Switzerland and is reported from all plantations or stands of *P. Striobus*. In the Canton of Zurich, the epidemic assumed such serious proportions that the private landowners who were formerly most enthusiastic about this pine, no longer dared to plant it. From the first data collected it would appear, that if a stem of a Weymouth pine is attacked at about the age of 10 years by the parasite, it is irremediably lost. If the trees have attained the age of 10-25 years, their destruction is not so certain. From a small experiment made in 1919, it may be considered, for the time being that trees of which the total circumference has been infected are certain to perish sooner or later.

The prophylactic control measures hitherto adopted are as follows:— (*a*) In the nurseries, only healthy, clean seed is planted, and this is immersed in a suitable antiseptic; (*b*) only healthy trees from nurseries immune from the parasite are used for planting; (*c*) all species of *Ribes* are excluded from the nurseries, and the latter are never installed near places where this plant is cultivated; (*d*) the cultivation of the Weymouth Pine is given up for some time in nurseries where the disease has been rife; (*e*) the

Weymouth Pine has been grown associated with other conifers and with foliage trees.

In Belgium, experiments have been recently made for the purpose of ascertaining whether there is any way of curing trees that have been attacked. The bark of some specimens of *P. Strobus* infected with "rust" were first scraped, so as to remove, as completely as possible, the portions invaded by the fungus, which were then collected and burnt. Next, the infected parts were painted over with permanganate of potash (a 10 % solution), pure formalin, pure paraffin, or carbolineum avenarius. The results obtained, however, do not lead to any definite conclusions; it is necessary for the experiment to be repeated on a large number of individuals. It may, however, be mentioned that in the spring of 1915, the trees treated with permanganate were completely cured and the other compounds were efficacious to a certain extent though not so definitely as the permanganate, the cure being partial only.

The Weymouth Pine is also attacked in Switzerland by other parasites though these so far, do not seem to have done it much injury; they are: *Armillaria mellea* Walh. (= *Agaricus melleus* Fl. dan.) and *Fomes annosus* Fr. (= *Trametes radiciperda* R. Hartig).

This conifer has also a certain number of animal pests in the Confederation.

The roe-deer, which have become fairly common in the Swiss forests during the last few years, often seriously damage the young trees by gnawing the bark.

The red field-mouse (*Hypodeus glareolus* Wagn.) (1) has here and there stripped off the bark of young individuals of *P. Strobus*.

Of the insect foes of the conifer, one aphis *Pineus strobi* Htg., has frequently appeared of recent years in stands 30 years of age or older. Opinions are divided as to the amount of injury it causes, but it is certain that the presence of a countless number of these insects engaged in sucking the surface of the bark cannot but interfere with the ordinary life-processes of the tree. The Scolytid coleopteron, *Xyloterus* (*Tomicus*) *lineatus* Oliv. has been recorded on felled trunks lying in the forest unstripped of their bark; *Pityophthorus* (*Bostrichus*) *micrographus* L. has been found on branches and small trunks: *Tomicus quadridens* Htg., *Myelophilus* (*Hylesinus*) *piniperda* L. and *M. minor* Htg., have been observed on the trunk and inside the shoots of the Weymouth Pine.

Curculionidae are also found here and there: the plantations have been much damaged by *Hylobius abietis* L., and trunks of *P. Strobus* that are infected with "vesicular rust" sometimes harbour individuals of *Pissodes pini* L.

The larvae of the hymenopteron *Lophyrus pini* L. (*Loph. similis* Htg.) have made their appearance regularly for some years towards the middle of September upon spring specimens of *P. Strobus* growing in the garden of the Zurich Forestry Institute, but without doing any great injury.

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(1) See also *R.* June, No. 609. (*Ed.*)

Finally, the caterpillar of a microlepidopteron, *Dioryctria splendidella* H. S., has been recorded in stands of *P. Strobus* since 1919, in Höhragen and the Rüti, which are infected by " vesicular rust ". This insect only attacks trees that are already diseased and is therefore of but little importance from the forester's standpoint. It must, however, be remembered that it increases the injury caused by the " rust ".

[1193]

ALFREDO RUGGERI, *gerente responsabile*

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1194 - **The Agricultural Production of Czecho-Slovakia.** — *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia*, Year I, No. 2, pp. 9-16, Prague, July 1, 1920.

NATURAL RESOURCES OF THE CZECHO-SLOVAKIAN REPUBLIC. — From the economic standpoint, Bohemia is one of the richest countries in the new State of Czecho-Slovakia. The superficial area is 52 000 km^2 and the Vetava and the Elbe (Labe) provide direct communication with Germany. Prague is the centre of the densest network of railways in the whole State and in Bohemia alone, there are nearly 5000 km. of railroads.

The country is rich and well cultivated. It supplies all that is necessary for the support of man, with the exception of salt, which must be imported from Germany, or Galicia. Cereals are the chief crops, after which come *beet roots* and the number of sugar-refineries is considerable. Bohemian *hops* of which the best come from Žatec and Rakovnik, are celebrated thoughout the world (area under hops from 1901 to 1910, 15 127 hectares; crop, 88 091 quintals). Some of the *vineyards* (Mělnik especially), produce a small quantity of choice wine (787 hectares; average production from 1901 to 1910, 11 385 hectolitres). The best variety of fruit is the *plum* which constitutes an important article of export (total crop from 1901-1910, 2 825 775 quintals).

Forests cover more than 1 561 000 hectares, some large owners possessing as much as 70 000 hectares. They are worked in a very intelligent manner (production in 1910, 3 242 717 m^3 of timber; 2 238 355 m^3

of fuel). They are also rich in game, as many as 700 000 head being killed in certain years. Bohemian pheasants have a high reputation, and there are more than 150 pheasant farms.

The most important *industries* of Bohemia are: 1) sugar-making, the sugar factories and refineries numbering 108 or over (production in 1912-1913: 7 517 000 quintals); 2) brewing (especially Pilsen beer). The beer is sent as far as America (annual output, 10 347 822 hectolitres). In 1910-1911 the number of breweries was 560.

Potatoes are much cultivated, most of the crop going to the distilleries (of which there were 316 in 1918-1919), and starch factories. The latter, 94 in number, use a great quantity of tubers; some also go to the glucose and dextrine factories. These industries have become the most important for export. The mineral waters have a world-wide reputation (K. Vary, Karlsbad, Bilína Marienbad, Franzensbad, etc.).

Mines are one of Bohemia's chief sources of wealth, the most important coal mines being those of Most, Kladno, Buštěhrad, and Rakovník, (output in 1911, 41 893 212 quintals of coal and 208 267 406 quintals of lignite).

Moravia (superficial area: 22 000 km^2), takes its name from the river Morava. The highest mountain peaks in the country are below 1500 m., there are no lakes, but about 50 mineral springs and the climate is temperate. At the time of the last census (1910), the population numbered 2 622 271 inhabitants. Moravia is an essentially agricultural and industrial country. Its principal products are *cereals*, *beetroots* and *wine* (between Znojmo and the Morava).

Sugar, *malting* and *brewing* industries are also well developed.

The basins of the Ostrava and Rosice are the centres of the *coal-mining* districts. The annual output of the mines exceeds 24 million francs (1911). The *textile* industry is concentrated at Brno.

Silesia has a superficial area of 5147 km^2 and 756 949 inhabitants. It is divided by the Moravian district of Mistek into two parts, the former provinces of Teschen (Těšín) on the east, and of Troppau (Opava) on the west. The country is mountainous and in the south abuts upon the Carpathian and Sudetic ranges; 50 % of the land is fields, 4 % pasture and 34 % forest. The harvests in 1914 consisted of 201 066 quintals of wheat — 675 018 quintals of rye — 384 323 quintals of barley — 936 453 quintals of oats — 4 500 000 quintals of potatoes — 455 172 quintals of sugar beets.

In 1919, the stock was estimated at about 24 118 horses — 111 217 cattle — 32 969 pigs — 47 781 goats — and 4 069 sheep.

Coal of excellent quality is mined in the Ostrava-Karvín basin, the annual output being 6 428 660 tons.

The *textile industry* is also flourishing: woollen goods are made at Bilsho, Krnov etc., linen thread and fabrics and cotton goods at Frýdek, etc. In addition there are sugar factories, breweries, factories of chemicals and by-products of wood, etc.

Slovakia is one of the most favoured countries of the world as regards abundance and variety of natural products especially those supplied by plants, and her industrial progress, which is as remarkable as it is recent, has not entailed the loss of her essentially agricultural character. In 1919, the stock was estimated at 149 299 horses — 897 410 cattle — 564 061 pigs — 532 320 sheep and 89 392 goats.

Flax and beet root are the most important *industrial plants.* The average crops from 1903 to 1912 (1) were: 5 581 284 quintals of wheat (area sown: 470 355 hectares) — 2 882 642 quintals of rye (261 471 hectares) — 5 299 883 quintals of barley (423 392 hectares) — 2 511 819 quintals of oats (277 700 hectares) — 1 756 865 quintals of maize (132 619 hectares) — 20 745 998 quintals of potatoes (259 746 hectares). About 60 456 hectares were under sugar beets (from 1903 to 1912). The total beet production (in 1914) reached 15 500 000 quintals. In 1918, Slovakia possessed 8 working sugar factories, and one that had been closed. The output of sugar is estimated provisionally at 316 102 quintals.

From 1918-1919, 430 *agricultural distilleries* of potatoes produced 108 483 hectolitres of alcohol and there are in addition 42 industrial distilleries. The 17 *starch factories* also take a large number of tubers. The *brewing industry* is not much developed. The output of 21 breweries in 1912-1913 was about 260 000 hectolitres.

The mountainous regions (the Carpathians) are rich is productive *forests.* According to private statistics, 2 million hectares are under forest which could produce annually 6 million m^3 of timber.

Iron, coal, salt, copper, silver etc. are chiefly found near Ŝtavnice, at the foot of the Tatra, and in the district of Marmoros. Over a hundred mineral springs have been opened, some of which are of first rate quality (Teplice, Trenčín, Pístány). The area of Slovakia is about 50 000 km^2 (preliminary data based on the publications of the former Hungarian kingdom).

TABLE I. — *Estates Administered by the Ministry of Agriculture of the Czecho-Slovakian Republic.*

	Forests hectares	Agricultural land hectares	Totals hectares
State lands	519 311	50 451	569 762
Grants of land	57 185	17 347	74 532
Estates belonging to the former Imperial Family	116 907	52 053	168 960
Totals . . .	693 403	119 851	813 254

Table II gives the results of the 1919 crops in Bohemia, Moravia and Silesia which are ¼ to ⅓ less than the pre-War returns (1914).

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(1) These data refer to the "comitats" situated on the left bank of the Danube and on the right bank of the Tisza. (*Author's note*)

TABLE II. — *Agricultural Production in* 1919 *in Bohemia, Moravia and Silesia.*

	Total production	Yeld in quintals per hectare		
		Bohemia	Moravia	Silesia
Wheat	4 182 829 qls	12.0	10.7	10.7
Rye	8 314 845	10.7	10.1	9.6
Barley	4 695 974	12.3	11.8	10.9
Oats	4 691 297	11.6	11.6	9.6
Mixture of wheat and rye (meslin)	91 663	10.5	7.6	7.1
Spelt	457	9.5	5.0	3.1
Maize	113 841	16.9	8.3	—
Millet	37 275	8.6	8.3	6.0
Buck wheat	7 267	6.6	4.3	3.7
Potatoes	22 886 172	64.9	61.3	69.6
Sugarbeets	36 364 391	213.5	197.0	166.0
Mangels	11 694 122	166.1	170.7	182.9
Chicory	890 750	155.5	103.2	82.6
Swedes	1 969 573	109.2	134.2	143.6
Turnips	64 499	108.3	87.8	136.1
Artichokes	14 425	80.1	73.2	98.5
Cabbages	1 996 417	135.3	144.8	178.8
Carrots	615 917	165.6	128.8	81.1
Onions, garlic	615 849	91.4	57.5	41.8
Colza	115 455	12.6	13.2	17.3
Poppy	36 842	7.1	6.9	7.3
Flax (tow)	76 571	5.3	5.8	5.3
Flax (linseed)	56 273	4.4	3.9	4.0
Hemp (tow)	3 265	8.8	6.1	—
Hemp (seed)	2 184	8.9	3.9	—
Peas	79 157	9.7	10.3	9.9
Lentils	9 825	6.6	6.4	4.0
Edible beans	6 748	8.7	7.9	9.4
Leguminosae (unspecified)	175 667	11.0	11.1	9.8
Clover (hay)	19 512 487	28.0	31.3	34.6
Clover (seed)	—			
Hay (meadow)	19 385 509	23.2	25.9	27.1
Hay (from other forage crops	1 684 058	14.2	17.6	18.1
Hops	43 518	5.1	4.8	

AGRICULTURAL INSTITUTIONS. MEASURES FOR THE INCREASE OF PRODUCTION. — The budget for 1920 presented by the Ministry of Agriculture to the Chamber shewed an expenditure of 139 259 621 crowns and a revenue of 81 652 833 crowns.

A new Agricultural Institute has been founded at Brno, in Moravia, a second was already in existence at Prague. The course of study lasts 4 years, after which the student (if satisfying the examiners), obtains the diploma of Agricultural Engineer.

There is an Agricultural College at Libwerda, where the course lasts from 2 to 3 years (1)

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(1) See *R.* Jan. 1921, No. 5. (*Ed.*)

A Union of Czecho-Slovakian farmers of all classes has been formed at Prague.

About 130 000 hectares of Czech land have recently been reclaimed. According to the estimate of the Ministry of Agriculture there are still 1 million hectares of land in Czech territory and 650 000 hectares in Slovakia which ought to be reclaimed.

The State has allocated 15 millions of crowns under the heading of State Improvements Fund for reclamation work and 4.25 million crowns under the heading of Land Improvements Credit.

SUGAR INDUSTRY. — Sugar production is becoming one of the most important economic factors in the State, especially as the output of all the other countries of Europe has decreased by 50 million quintals.

According to the figures published by WILLET and GRAY of New York the beet sugar output for the year 1912-1913 was as follows.

TABLE III. — *Sugar Production in* 1912-1913.

Austria-Hungary	19 020 000	quintals
Germany	27 010 000	»
France	9 610 000	»
Belgium	2 990 000	»
Netherlands	3 160 000	»
Russia	13 740 000	»
Other States	7 170 000	»
Total	82 700 000	quintals

80 % of the total sugar production of the former Austro-Hungarian Empire is concentrated in Czecho-Slovakia : its annual pre-War production may be estimated at 11-15 millions of quintals, that of 1919-20 at 6-7.5 millions of quintals (1) (the output in Germany was 13 million quintals; in Russia 3.5 million quintals; in Sweden 14 million quintals; in Italy 1.5 million quintals; in Spain 1-2 million quintals; in Switzerland 40 000 quintals).

In 1912-1913 the number of sugar factories was : 108 in Bohemia ; in Moravia and Silesia 56 ; in Slovakia 9 : total 173.

The areas under beet were : 149 000 hectares in Bohemia, 110 000 hectares in Moravia and Silesia, 60 000 hectares in Slovakia ; total 325 000 hectares.

The amounts of beets used at the sugar factories were : in Bohemia 49 000 000 quintals ; in Moravia and Silesia 30 000 000 quintals ; in Slovakia 16 000 000 quintals ; total 95 000 000 quintals.

The sugar obtained was estimated at 7 817 000 quintals in Bohemia,

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(2) According to figures furnished by the Union of Sugar Factories, the sugar yield per hectare is estimated at 37.2 quintals. In 1919, 36 million quintals of beets were lifted in the Czech countries (Bohemia, Moravia and Silesia). The area sown with beets was 175 251 hectares.

4 333 000 quintals in Moravia and Silesia, 2 850 000 quintals in Slovakia, total 15 000 000 quintals.

Sugar occupied the first place among the exports of the late Monarchy; in 1913 sugar to the value of 294 million crowns was exported. In 1919-1920, it is expected that it will be possible to export 3 million quintals valued at 980 million crowns.

The Republic of Czecho-Slovakia is one of the countries in which beet growing and the manufacture of beet sugar have made the most remarkable progress during the last 40 years. The War has however greatly injured the beet cultivation industry.

In 1919, the Republic of Czecho-Slovakia exported 2 826 990 quintals of sugar, distributed as follows: France 550 000, Jugo-Slavia 124 788, Germany 263 450, Siberia 288 302, Austria 1 600 450 quintals Thus over 50 % of the total sugar exported went to Austria.

The maximum price of sugar beets was fixed at 15 crowns per quintal for the year 1919-1920, and at 26 crowns per quintal for 1920-1921.

HOPS IN BOHEMIA — The hop growing region of Bohemia lies to the north of the country on the Saxon frontier between 50° and 50°.7 lat and 30° and 32° long. It consists of 3 chief divisions:

1) The red country of Žatec (Saaz).
2) The red country of Ouštěk (Auscha).
3) The green country of Dubá (Dauba).

Since September 17, 1912, a law has been passed prohibiting the sale under the name of " Bohemian hops " of hops coming from any towns other than Žatec, Ouštěk and Dubá, where there are special hop markets.

The red Saaz country, so called because only red-stemmed hops are grown (the cultivation of the green-stemmed variety being forbidden throughout the region by the Statutes of the Saaz planters), contains 11 295 hectares of hop-gardens, divided (in 1911) between 9218 cultivators. This district, which produces the most prized type of hop forms a vast, almost circular, basin surrounded on all sides by mountains. The best plantations are on the slopes of the hills where they are sheltered from the north and west winds.

The situation of the hop-gardens of Saaz is worth attention, as showing the importance attached to the protection of the plants, for whereas ordinary crops occupy the plateaux, the hops cluster along the slopes and in the valleys. Hence they enjoy specially favourable conditions of growth and the cultivators select the best spots with the greatest care. There ie a striking analogy between the situations occupied by the hop-gardens os the valley of the Rézat, at Spalt (the choice growth of Bavaria), and thosf of the Valley of the Eger at Saaz. The soils of the two localities are very different.

The annual rainfall is 500 mm., the average during the summer months, April to October, being 377 mm. It is be noted that it rains very little in the Saaz district, much less than in other parts and to this relative dryness are attributed the size and flavour of the Saaz hops.

The average annual temperature is 9°C.; in summer the temperature is about 15 C. The winters are cold, but it is sometimes very hot in summer, and after July, a period of drought sets in and often lasts until the end of harvest, being broken only by a few storms. August, when the hop finishes flowering, is a particularly fine hot month.

Owing to the configuration of the ground, the neighbourhood of the slate rocks of Štredohoří (Erzgebirge) and the basalts of the Riesengebirge etc., the soils are of very different composition. Near the town of Saaz the finest hops are grown on stiff clays, and are sheltered from the cold winds by chains of hills and mountains.

The red country of Auscha lies to the south of the Saaz district and here red-stemmed hops only are grown (2998 hectares were under hops in 1911). All the northern part of the region forming the red Auscha country proper, of which Auscha is to some extent the centre, is intersected by wooded hills separated by valleys whose abrupt granite slopes are covered by hop-gardens.

The mean annual temperature is the same as at Saaz, but the heat in summer is a little greater, the thermometer registering 17.5° C. on an average.

The annual rainfall is 613 mm., 416 mm of rain falling during the 6 summer months.

The soil is generally calcareous, and the rocks are masses of weathered basalt

The green country of Dauba is so-called because green stemmed hops are almost exclusively grown. It lies east of the Auscha district, exactly following its contours. Dauba is the smallest hop-growing region in Bohemia, having only about 539 hectares under hops. In character it is very diversified, high, wooded plateaux alternating with deep and very fertile valleys

Hop Cultivation. — This is practically of the same nature in the three districts.

In the autumn, the ground is ploughed deeply, and the clods are left untouched through the winter. In the spring, before pruning, the hop-gardens are again ploughed (but less deeply) along and across the rows, so as to form a square mound round each plant. The stocks are uncovered with a hoe.

Pruning takes place from April 15 to May 15, and is relatively late. Pruning is a little earlier at Auscha and Dauba than at Saaz where it is never begun before the end of April. During the summer until the flowering, the soil is lightly hoed to keep it friable and clean.

The hop-gardens are chiefly manured with dung, spread only once in two years and in the autumn before the first ploughing At Saaz, 8 to 10 kg. of manure is put round each plant; in Auscha, it is spread between the rows, 10 or 15 kg. being given to every two plants; at Dauba, the amount used is 5 kg. per plant. Chemical fertilisers are also applied. At the flowering time, the hop-vines are watered with dilute liquid manure. Some of the hops are grown on poles and the others on wire At Saaz, the wire props increase in number every year, and the oblique system is preferred. At Auscha and Dauba poles are more used, on account of the proximity of the forests and the low price of wood.

At Saaz the hop grows to between 6 and 7 metres on the hills and to 8 m. on the low-lying ground. It attains 7 to 9 m. at Auscha, but only 4 to 6 m. in Dauba, where the growth is less vigorous. If the vegetative development is too luxuriant, the top or side-shoots are removed, but a peculiar feature about hop-cultivation in Bohemia is that the bases of the shoots are not always deprived of their leaves. In Saaz hops are planted 1.30 m. to 1.50 m. apart, in a square, which means 4450-5950 per hectare. In the red Auscha region, the spacing of the rows is 1.25 m. to 1.50 m. In the green Dauba region, it is never more than 1.20 m. to 1.30 m. giving 7500-7900 plants per hectare.

In all 3 regions however 2 shoots only are kept per stock which allows the plants and rows to be closer.

Production however is not on a large scale. It is estimated that in order to obtain 50 kg. of hops, it is necessary to have 10 *schocks* (a *schock* consists of 60 plants) at Saaz, 7 at Auscha and 5 at Dauba The better the quality of the hops, the fewer are needed.

The crop often falls below these figures, and even in good years is only 8 to 10 quintals per hectare, according to district. The hops are picked with the greatest care, each flower being taken separately and freed from leaves or stalk. A first sorting is made during the picking, all the spoilt hops being placed on one side; the rest are removed in baskets to the barns and sorted a second time by 3 cm. sieves with a gentle backwards and forwards movement. Hops that are too large, or have grown two or three together, the leaves etc., remain in the sieves. Those that have passed through the meshes are removed by hand, and again sifted. The final residue is mixed with the hops rejected during the picking and sold as second quality hops.

TABLE IV. — *Distilleries and Alcohol Production (in hectolitres) in Czechoslovakia.*

	No. of distilleries	Alcohol produced	
		in 1917-1918	in 1918-1919
Agricultural distilleries:			
in Bohemia	300	33 729.56	50 808.32
» Moravia	161	29 430.55	36 417.33
» Silesia	101	7 314.63	10 305.94
» Slovakia	430	?	108 483.20
Industrial distilleries:			
in Bohemia	16	136 444.10	174 814.03
» Moravia	9		
» Silesia	4		
» Slovakia	42		

DISTILLATION — Table IV shows the amount of alcohol made in Czecho-Slovakia.

In 1914-1915, Bohemia produced 452 630 hectolitres of alcohol (52.93 % of the alcohol output of the Austria of former days) Moravia 214 496 hectolitres (25.08 %), and Silesia 71 478 hectolitres (8.36 %). Of the total alcohol production of Hungary, 36 % came from Slovakia.

In the year 1917-1918, the distilleries of Czechoslovakia used 18 000 quintals of potatoes and 518 000 beetroots.

The country has been able in consequence of the increase in potato distilleries to introduce improvements in soil-cultivation, the fattening of stock, etc. The legislation dealing with alcohol distilleries gives special privileges to agricultural potato distilleries. The smaller factories are favoured by a progressive tax based on the possible output of the distillery.

The amount of alcohol consumed in Czecho-Slovakia is estimated at 800 000 hectolitres, and half the distilleries are in full work. After the sugar-tax the alcohol tax is the source of greatest revenue to the State. In the budget of 1920, the proceeds of this tax were reckoned at 34 million crowns.

STARCH-MAKING. — The potato crop is of considerable importance in Czecho-Slovakia. According to the statistics (from 1903-1912) 508 210 hectares were under potatoes in the Czech countries and about 259 746 hectares in Slovakia. It is difficult to state exactly how many of these hectares are reserved for growing potatoes for industrial purposes properly so-called. The yield per hectare was 98.8 quintals (79.9 quintals in Slovakia) with a total production of 50 219 253 quintals (20 745 998 quintals in Slovakia). The districts where potatoes are most grown are Slovakia and the Czecho-Moravian plateau, and hence in the parts considered the richest from an agricultural standpoint, as possessing the most fertile soils. A large portion of the crop goes to the starch factories.

There are 142 starch-factories in Czecho-Slovakia, 94 in Bohemia, 29 in Moravia, 2 in Silesia and 17 in Slovakia. About 450 000 quintals

TABLE V. — *Alcohol Production and Exportation Returns for (pre-war) Austria and Hungary (in hectolitres).*

Years	Austria		Hungary	
	Production	Exportation	Production	Exportation
1910–1911	1 786 299	312 112	—	—
1911–1912	1 592 392	95 689	—	—
1912–1913	1 619 231	242 888	1 309 216	121 860
1913–1914	1 590 376	249 649	1 392 179	157 050
1914–1915	855 187	105 480	1 024 165	95 210
1915–1916	—	—	821 216	130 947

of starch, glucose and dextrine of the value of 19 million crowns, were produced before the war. These products have become in the course of time the basis of important export industries

In Czecho-Slovakia, 220 000 quintals of starch were consumed and about 230 000 quintals (of the value of 10 million crown) were exported to the other countries of the former Monarchy. The first States to which exports were sent were Austria, Jugo-Slavia Bulgaria, and Rumania

The 125 starch factories in Bohemia, Moravia and Silesia used before the War on an average, 2.2 million quintals of potatoes a year, while 1.2 million quintals were supplied to the 17 starch factories in Slovakia. The starch industry includes 3 branches, producing starch, glucose and syrup, dextrine and artificial gum. The 3 branches are very intimately connected, and must be regarded as forming a single industry. During the War the output decreased, as the Government did not allow the manufacture of starch from potatoes.

1195 – **Agriculture in the State of Rio de Janeiro, Brazil, According to the President's " Message ", Addressed to the State Assembly. (Session of August 1, 1921)** (1) — *Lavoura e Criação*, Year VI, No 8, pp 162-176 Rio de Janeiro, August 1921

The President of Rio de Janeiro, Dr Raoul DE MORAES VEIGA, in reviewing the economic condition of the country, enumerates the chief sources of revenue derived from the export taxes levied upon the most important agricultural products. Coffee occupies the first place, this tax alone furnishing $^4/_5$ of the total revenue from 1892 to 1900 Owing to the large amount of coffee grown, a monocultural system has been almost exclusively adopted, which is not suited to a fertile soil such as characterises this State. The crisis due to the fall in the price of coffee was especially acute in 1902, and hence the Government was induced to advocate polyculture During the War, coffee rose very much in price, and the returns from the export tax (to which must be added a supertax of 3 fr. per sack), increased. In 1919 this tax reached its maximum and brought in 6 198 691 *milreis* (1 gold *milreis* = 2 832 fr. at par), the supertax bringing in 2 273 453 *milreis*

In 1920, the tax on sugar amounted to 2 079 994 *milreis* and the supertax to 1 141 198 *milreis*, figures much higher than had ever been reached before In the same financial year, the export taxes on the following agricultural and stock-breeding products that chiefly contributed to the budget were as follows

Vegetable products	50 142 *milreis*
Maize.	60 900 »
Palm-oil	3 141 »
Horses	2 241 »
Mules	1 591 »
Cattle	13 343 »
Goats (1st six months 1921)	2 250 »
Pigs (1st six months 1921).	2 163 »

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(1) For the Development of Agriculture in Brazil, see . *R* June 1921, No 592, *R* July 1921, No 700, *R* Nov 1921, No 1078 (*Ed*)

The tax on alcohol alone brought in 349 995 *milreis.*

From January 1, 1919 to June 30, 1921, 4 881 112 *milreis* were expended on the regulation of the rivers, improvement works, rural prophylaxis and similar objects.

By Decree No. 1721 of 1919, the " Inspectoria de Agricultura " (Agricultural Inspection Service) was re-established. It is connected with the Botanic Garden of Rio de Janeiro, and its function is to assist the Government in encouraging Agriculture, being especially intrusted with botanical prophylaxis, and the promotion of the purchase of Agricultural implements and machines, and of the study of crops, including sylviculture.

The " Inspectoria " has begun the gratuitous distribution of selected seeds. From August to October 1920, 31 500 kg. of seed potatoes and 13 007 kg. of the seed of " capim gordura rôxo " (*Andropogon rufus*) (1) were thus disposed of, and in addition, beans, rice and maize. This institution also facilitates the purchase of sulphur, agricultural implements, etc

A system of prize competitions for various crops has also been established.

The climate and rich pastures of Rio de Janeiro are admirably suited tor stock-breeding.

The shows held in 1918 and 1920 by the " Sociedade Nacional de Agricultura " at Cordeiro (Municipality of Cantagallo), proved the progress made in stock-rearing. The first Government Stud Station was founded at Cordeiro in 1920, and provided with pure-bred bulls (Polled Angus and Red Poll), bought in England and Argentina.

According to the figures supplied by the General Direction of Statistics, the State of Rio de Janeiro possesses: 556 220 cattle — 142 890 horses — 101 200 asses and mules — 63 510 sheep — 89 670 goats — 602 560 pigs

There is certainly a great future for stockbreeding.

A large refrigerating establishment is being built at Iguassú by the " Companhia Pecuaria e Frigorifica do Brasil ". Here the meat of cattle, sheep, pigs and poultry is not only frozen for export purposes, but is also canned, lard etc. are also manufactured.

The Lancashire General Investment Trust, Limited owns the Packing House at Mendes, in the Municipality of Barra do Pirahy (2).

The following industries are fairly developed: textiles (28 factories including 23 cotton, 2 silk, 1 wool and 2 lace factories); preserves (241 factories); sugar-making (the Municipality of Campos itself possesses over 30 sugar-factories); there are also 64 factories of various beverages.

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(1) See *R* Aug 1921, No 816 (*Ed*)
(2) See *R* July 1921, No. 766 (*Ed.*)

1196 - **The Influence of Accessory Factors (Vitamines) on Dentition.** — HOWE P. R. in *Bulletin de la Société scientifique d'Hygiène alimentaire et d'Alimentation rationnelle de l'Homme*, Vol. IX, No 5, pp. 308-313. Paris, 1921.

The author describes the types of dental troubles produced in guinea-pigs by a diet based almost exclusively on oat-bread and skin milk, and therefore deficient in the 3 kinds of known vitamines. It would appear, that the same foods are required for the development and preservation of the teeth, as are indispensable to growth and the maintenance of health. These necessary articles of diet are: whole milk, fresh vegetables, and especially green vegetables, various leaves, fresh fruit and whole seeds.

1197 - **Maize in Bread-Making as the Cause of Encephalitis lethargica.** — VIGER, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol VII, No. 31, pp. 652-655. Paris, October 12, 1921

In a memoir entitled *Contribution à l'étude de l'encéphalite léthargique et de la grippe infectieuse*, Dr. VEILLARD, of Meung-sur-Loire attributes *encephalitis lethargica* (Sleeping sickness), to a diet of bread containing maize and considers the disease to be very similar to pellagra. Bleached maize flours freed from oil are more dangerous when substituted for wheat flour than the yellow kinds. Dr. VEILLARD does not suggest that maize should be prohibited as an article of human food, but advocates most strongly that it should not be incorporated in flours in place of wheat flour.

CROPS AND CULTIVATION

1198 - **Relation of Cultivation of "Abaca" (*Musa textilis*) to Climatic Conditions in the Philippines.** — ROSALES, S. P., in *The Philippine Agriculturist*, Vol IX, Nos. 8-9, pp. 219-227. Los Baños, March.-April, 1921.

Abaca-growing is almost exclusively a Philippine industry, as the attempts made to cultivate it in other tropical countries have met with but little success. The fibre of this plant is widely known and extensively used in the manufacture of cordages, clothing, etc. Therefore every effort should be made to determine the parts of the Philippines where it is possible to grow *Musa textilis* Née. Climate is certainly the most important factor. Three types of climate can be distinguished in these islands:

First type: Total annual rainfall 2766 mm., no dry season. Humidity 78-88 % with slight variations. Temperature: . Average less than 27° C.

Second type: Total annual rainfall 2453 mm., dry season lasts 5 to 6 months. Humidity: wide range, 70-86%. Temperature: around 27° C.

Third type: Total annual rainfall, 1856 mm., dry season lasts 1 to 2 months. Humidity very small range. Temperature: around 26° C.

The great variations in the climate, and especially in the distribution of the rainfall in different parts of the archipelago, make it possible to grow practically all tropical products in the same region by artificial means, such as irrigation and shading.

Of the 3 types of climate described, the first is the most favourable for the growth and development of *Musa textilis*. This type of climate is found at Albay (total annual rainfall: Legaspi, 3572 mm.), Ambos Camarines (Paracale, 4825 mm.), on the east coast of Samar (Borougan, 4177 mm.), at Leyte and Mindanao and on the Northern coast of Mindanao.

Abaca can however be grown though to a more limited extent, with the second or third type of climate, such as is found at Cavite, Mindoro, Negros, etc. In the upland region of the province of Cavite (2nd type), the plant can be cultivated successfully, probably on account of the high altitude and consequently low temperature and great humidity. In the following Table comparisons of temperature are shown between the province of Cavite and the two provinces, Leyte and Albay which produce the largest amount of Abaca.

Temperatures of Leyte, Albay, and Cavite (in degrees Centigrade).

Provinces	Mean maximum	Mean minimum	Average mean $\frac{\text{max.} + \text{min.}}{2}$
Leyte	29.9° – 32.8°	21.7° – 24.2°	27.2°
Albay	29.8 – 33.7	21.6 – 24.7	27.5
Cavite	29.4 – 31.8	18.3 – 20.0	24.9

Although Cavite has a long dry season of 6 months' duration, its temperature is lower than that of Leyte or Albay; hence the evaporation from the soil and the transpiration of the plants are less active which tends to counteract the dryness of the climate.

1199 – **The Factors Determining Soil Temperature.** — KEEN, B. A., and RUSSELL, E. J. (Rothamsted Experiment Station, Harpenden, Herts.), in *The Journal of Agricultural Science*, Vol. XI, Part 3, pp. 211-239, 13 figs. Cambridge, July 1921.

The object of this paper is to discuss the factors influencing soil temperature. The flow of heat emanating from the interior of the earth's crust is however not taken into account, as this source of warmth is but of negligible importance as regards the soil. The authors also investigated the extent to which other measurements, such as air, temperature, hours of sunshine, etc., can be made to give information as to soil temperature in cases where direct determinations have not been made.

The material of this discussion is provided by readings of a continuous, self-recording thermometer buried at 6" in the soil at Rothamsted, and those of a series of other thermometers exposed on a screen open to the air, or buried in the soil. Sunshine and radiation recorders were also used. The soil above the thermometer was carefully kept free from all plant growth. The period dealt with is from Dec. 22, 1913 to Dec. 23, 1914, although the records have been and will be continued.

The winter temperature curves differ from those obtained in summer. In winter, there is practically no variation during the day, though fluctuations may extend over a several day period, the maximum of one day being the minimum of the next. In summer however there is a marked daily variation; the rise of the temperature which begins on the surface at day break penetrates to the 6″ depth at about 9.30 a.m. The rise is then continuous till about 4.30 p. m., when it slackens or ceases; after 5.30 p. m., there is a fall which is much slower than the rise, lasting till 8 a. m. or thereabouts. Thus, at the depth of 6″, the temperature rises for about 7 or 8 hours, and falls for about 15 or 16 hours, there often being a flat period of varying duration at each end. The mean temperature is passed about midday, and again at about midnight: the warm period in the soil is thus from midday to midnight, and the cool period from midnight to midday. The soil maximum at 6″ is attained about 3 hours later than the air maximum on the screen.

The maximum soil temperature is not very closely correlated with the number of hours of sunshine, the coefficient for the whole observation period, February 2—December 23, 1914, being 0.434 ± 0.032. The coefficient is even less (0.357), when account is taken only of the hours of sunshine up to 12.30 p. m., which alone would be expected definitely to influence the maximum soil temperature. On the other hand, the extent of the temperature rise at 6″ depth is closely correlated with the amount of solar radiation as recorded by the WILSON radio-integrator (the correlation coefficient being +0.877 ± 0.009), and to a less extent (correlation coefficient +0.78 ± 0.015), with the hours of sunshine.

The extent of the daily rise is adversely affected by rainfall, but apparently not by wind. The surface of the soil gives a temperature considerably above that of the air. At 6″ depth however the temperature is so much diminished, that the maximum is approximately the same as in the air during summer, though it is about 3° C lower in winter.

The cooling of the soil, which determines its minimum temperature, is increased by clear nights, but is retarded during autumn by rainfall which prevents the soil from cooling as much as it would otherwise. The cooling of the soil does not usually proceed as far as the cooling of the air. In summer, the soil minimum may be 6° or 8° C above the air minimum, and in winter, it is 3° C or more above; further, the minimum soil temperature is attained earlier in summer (7.45 a. m.) than in winter (10.30 a. m.), whereas in the air, the minimum is attained at approximately the same time (3.45 a. m.), all the year round.

The maximum temperature at 6″ depth during the summer was usually about 22° C, though it rose to 26.5° C on one occasion; the minimum was about 18° C, rising to 21° C. The mean temperature was about 20° C. This mean value was found to show less relationship to radiometer or sunshine values than the maximum temperature. The amount of soil moisture however showed a tolerably clear connection. Though the data are not strictly comparable, it is evident that the soil warmed as it dried, and cooled as it became moist. The transition from winter to summer values takes place quickly, as a result of a concurrent increase in soil dryness and in solar radiation. In early winter the cooling of the soil is also rapid; this is probably due to the fine October nights when radiation is considerable; rainfall retards the process of cooling.

It thus appears, that the edaphon, or soil population, enjoys a warmer climate than that of the atmosphere; further the climate is also moister; the conditions of the surface soil during summer resemble those of a 20° C incubator.

As regards instruments for determining soil moisture, the ordinary 12" soil thermometer, when used alone, proved unsatisfactory; its readings corresponded with the minimum but not with the mean temperature. The air thermometers were also insufficient by themselves, although the mean soil temperature is often about 3° C above the mean air temperature. A fairly, satisfactory value for the mean soil temperature is obtained by regarding the maximum air temperature as the maximum soil temperature, and the 12" soil temperature at 9 a. m. as the minimum and when taking the mean.

An increase in either the hours of sunshine, or the radiometer values, results in an increase in the ratio. $\frac{\text{soil amplitude}}{\text{air amplitude}}$; if the one increases, so does the other, and an increase in the thermometric variation of the soil as well as an increase in that of the air are also associated with an increase in this ratio.

The article concludes with an appendix containing: a description of the recording soil thermometer used, designed by Sir Daniel HALL, description of the British Meteorological Office type of Soil Thermometer, the Air Thermometer, the WILSON Radio-integrator, and the CAMPBELL-STOKES Sunshine Recorder, all used in these observations.

1200 – **Aqueous Vapour Pressure of Soils.** — THOMAS, M. D. (Utah Agricultural Experiment Station). in *Soil Science*, Vol. XI, No. 6, pp. 409-433, 5 figs., bibliography of 35 works, Baltimore, June 1921.

In all soil studies a knowledge of the soil solution *in situ* is highly desirable both as regards the mechanical action of the soil particles upon the solution and the influence of any dissolved material. When the soil solution is removed by centrifuging or by applying pressure, it is evident that the liquid thus obtained cannot exhibit the same properties as when distributed over the surface of the soil particles. The vastly greater water-holding capacity of clay, as compared with sand, and also the absorption of such salts as sodium carbonate necessitate special methods of research. The most obvious physico-chemical method to use in studying soil solution directly in the soil is the freezing-point lowering; this has been extensively employed by BOUYOUCOS and others, though there are several serious objections to it. Of these, the chief is that since the soil cannot be thoroughly stirred, the observed depressions do not indicate the true freezing points, and the results are therefore at best merely relative. Further the method is not applicable to the drier soils. Again, it is possible that the relations which obtain at ordinary temperatures do not hold at the freezing temperature though these discrepancies would not probably be large. BOUYOUCOS' dilatometric method seems to give very significant information over a range of moisture content extending from somewhat less than wilting coefficient, to very wet, but gives no details about "hygroscopic" moisture except to fix its maximum and indicate that it is held by very powerful forces. Hence the general application of this method is a matter of considerable difficulty. The conductivity method may be useful in supplying qualitative evidence as to the soluble salt content of the soil solution when the moisture content is high, but it fails when applied to drier soils. Cultivation experiments also give very limited results, the wilting coefficient and the toxic limits of alkali salts vary with different atmospheric and bacterial conditions, so that it is difficult to assign to them any exact theoretical significance.

On the other hand, the vapour pressure of the soil solution should supply abundant quantitative information about the soil, for this function being a property of the free energy at the surface of the moisture film, is fundamentally bound up with such other properties as the osmotic pressure, moisture equivalent, concentration of dissolved substances and the effective diameter of the soil particle, (that is, the total surface of the soil) Thermodynamic relations are known or can be deduced, by which most of these properties can be calculated directly from the vapour pressure

Precise measurements of the vapour pressures of certain solutions have been made by several investigators. Two general methods have been used : 1) The static in which the pressure differences are observed directly on manometers ; 2) the dynamic which consists in passing a known volume of air through a substance, collecting and weighing the vapour, and computing the partial pressure from the gas laws. The experimental difficulties, which would be even greater for soils than for solutions, led the author to abandon the static method temporarily in favour of the dynamic method. He used an apparatus by which it is possible to measure accurately the aqueous vapour-pressure lowerings of the soil to 0.01 mm of mercury at 25° C.

The author applied this method to a sand from River Heights, 2 clay loams, and a silty clay separate (the clay portion of a soil separated by decantation) He also determined the effects produced by salts causing the so-called alkalinity of the soil sodium chloride, sodium carbonate and sodium sulphate.

The vapour-pressure-moisture curves are shown to be rectangular hyperbolae when traced over a wide range of moisture contents. This means that the vapour pressure is proportional to the reciprocal of the moisture content.

As for the three sodium salts, they are absorbed by the silty clay loam, to the extent respectively of 10-44 % of the chloride, 70 %, of the sulphate and 85-90 % of the carbonate, though the chloride and sulphate can be extracted completely. By analysing the energetic functions of the soils studied, the author was able to determine the correlations between vapour-pressure and .the following properties hygroscopic coefficient, wilting coefficient, moisture equivalent, BOUYOUCOS' "solid water," capillary potential, surface tension, and curvature of the moisture surface.

The author intends continuing his investigations, but hopes that the work will appeal to others, and that vapour-pressure studies will take an important place in soil researches.

1201 – **Measuring Soil Toxicity, Acidity and Basicity.** — CARR, R. H. (Indiana Agricultural Experiment Station, La Fayette, Indiana), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIII, No. 10, pp. 931-933. · New York, October 1, 1921.

It is well known that a very acid condition of the soil is unfavourable to the growth and development of many plants. The cause of this poor growth has been attributed to lack of available calcium and magnesium, to the presence of toxic salts of aluminium and iron and to the presence of free acid (H-ion concentration). The fact that aluminium salts are toxic has been reported by many workers. The extent to which iron is toxic when associated with aluminium in acid soils is not so well understood, but the author believes, that the conditions making it soluble enough to be toxic occur infrequently.

The author has made a study of soil composition and toxicity as related to the root rots of maize, and has attempted to develop a method for determining soil acidity based upon the fact that in the absence of calcium, magnesium or other bases in the soil, the aluminium and iron salts can act as bases to form soluble salts. It was noticed by COMBER (*Journal of Agricultural Science* X, 420, 1920), that when an alcoholic solution of potassium thiocyanate was shaken up with an acid soil, a red colour developed, more or less in proportion to the acidity of the soil This red colour was due to the formation of ferric thiocyanate from soluble ferric iron in the acid soil. The presence of aluminium in the alcoholic solution can readily be shown by the addition of a few drops of an alcoholic solution of logwood which produces a blue colour somewhat in proportion to the amount of aluminium.

If 50 gm. of 10-mesh soil are treated with 30 cc. of a saturated solution of potassium thiocyanate in 95 % alcohol and shaken for 2 minutes, the liquid will become pink or red if the soil is acid. On adding from a burette a 0.10 N. alcoholic solution of potassium hydroxide until the colour disappears (at which moment a change takes place at H-ion concentration of $P_H = 5.5$) the amount of lime required by the soil is obtained. Each cubic centimetre of 0.10 N base is equivalent to 200 lb. of calcium carbonate per acre. If no red colour develops, the soil is basic, and by adding from a burette a 0.10 N alcoholic solution of hydrochloric acid, the calcium carbonate equivalent of the soil may be determined.

The author tried this method on 20 soils and determined the calcium carbonate recovered after some pot culture experiments. Hence it appears, that the method suggested lends itself to the determination of either the acid or basic condition of a soil, as well as of the soluble aluminium and iron present.

1202– **Nitrification in Some South African Soils.** — HALL, T. D. (School of Agriculture and Experiment Station, Potchefstroom, South Africa), in *Soil Science*, Vol. XII, No. 4, pp. 301-363. 10 figs., bibliography of 49 works. Baltimore, October 1921.

Although the study of the rate and amount of nitrate formation as a means of judging the biological activity and also the general fertility of the soil has received a great deal of attention in Europe and America, and has not been neglected in India, Australia, and other countries, it appears that no quantitative data exist respecting nitrification in the soils of South Africa.

The subject is of special interest, because the application of mineral nitrogenous fertilisers to soils in South Africa has not given the expected returns, and in some cases none at all. Green manuring with Leguminosae has proved the only manner of applying nitrogen that has given satisfactory results at the Potchefstroom Experiment Station The fact that the average South African soil is poor in phosphates may be sufficient to account for the lack of response when mineral nitrogenous fertilisers are applied alone; but soils, with a low nitrogen content according to European standards, often give excellent returns in South Africa, when the rainfall is sufficient and no nitrogenous fertiliser has been used.

The author therefore undertook a series of experiments with the object of obtaining quantitative data on nitrification in South African soils for the purpose of comparison with the soils of other continents and of ascertaining whether the process of nitrate formation is as active as has been assumed. The scheme of his work was as follows: 1) to ascertain the amount of nitric nitrogen in the virgin, cropped and cultivated soils around the Potchefstroom Experiment Station, at various seasons of the year and after various crops; 2) to correlate the seasonal variations of nitrate with the climatic conditions; 3) to ascertain the amount of nitrogen in the first 5 feet of the soil in various sections of the locality studied; 4) to compare the nitrifying powers of each of the successive 5 feet of soil and see how far nitrification was active; 5) to see how much limestone and slaked lime affected nitrification on dry-land plots growing potatoes; 6) to compare the nitrifying powers of irrigated and long cultivated land with virgin dry lands in regard to the various amounts of blood-meal and ground limestone applied, 7) to find out how much nitric nitrogen was added to a soil by cowpeas (*Vigna Catjang*) alone, lime alone, and by mixtures of the two; 8) to compare the nitrifying powers of soils from different parts of the South African Union with one another, and to ascertain the nitrogenous fertiliser most easily nitrifiable (whale guano, fish guano, cyanamide, dried blood, ammonium sulphate, cow-pea hay and sewage sludge); 9) to compare the nitrifying powers of virgin and cultivated soils of the same type; 10) to correlate, if possible, the nitrifying power of soils with the amount of rainfall in the area whence they came; 11) to compare the nitrifiability of ordinary whale-guano, ether-extracted whale guano and sulphated whale-guano; 12) to compare the nitrifiability of small and large amounts of nitrogeneous fertilisers and to ascertain, if possible, which is better for comparing the nitrifying powers of various soils.

The examination of 54 samples of soil from various parts of South Africa showed that the nitrification in them was much less than in the 45 humid soils investigated by LIPMAN and his collaborators, or even in the majority of the soils of the semi-arid districts of California and Colorado, but it was greater than in the Texas soils.

[1282]

In short, though nitrification is good in South African soils as compared with soils from some areas, it cannot be said to be exceptionally active. The data confirm what has already been recorded in the West of North America, viz., that in the soils of arid and semi-arid regions nitrification is not very intense, nor is it always greater there than in the soils of humid areas. In the region studied by the author (that of summer rainfall), however, the nitrification seems quite adequate for the average crop production. The last study showed that 5 % of the soil nitrogen on the Potchefstroom Experimental Station could be nitrified under optimum conditions in 30 days. This means a capacity for producing about 180 pounds of nitric nitrogen per acre-foot, which is however a higher capacity than was shown by most samples of the soils tested. Nevertheless nitric nitrogen was always found on the dry-land plots, even at the time of the most active growth of the maize crop.

The seasonal variation data seem to point to better and more active nitrification at Potchefstroom than at Rothamsted, but as seasonal-variation field data from Ithaca, N. Y., show larger amounts of nitric nitrogen to be present than in Transvaal soils, it cannot be affirmed that nitrification is generally more intense in these soils than in the soils of most temperate climates. It can however be stated, that where the maximum rainfall and temperature coincide, there is a maximum nitrification at the time of greatest crop growth. Thus it seems that there is not much need of nitrogenous fertilisers in the summer rainfall area. On the other hand, farm practice shows great benefit from nitrogenous manures in the Cape areas of winter rainfall, where the optimum conditions of moisture and temperature occur at different times.

1203 – **Direct Application of Mineral Phosphates to the Soil in the United States.** — STONE, R. W. (United States Geological Survey, Washington, D. C.), in the *American Fertilizer*, Vol. LV, No. 9, pp. 82-94. Philadelphia, October 22, 1921.

The use of crude mineral phosphate for direct application to the soil has considerably increased in the United States during the last few years, and it seems, that excellent results have been obtained as regards crop

Years	Phosphate sold	Phosphate exported	Phosphate sold for direct application
1914	2 734 043 *long tons* *	964 114 *long tons*	48 317 *long tons*
1915	1 835 667 » »	259 421 » »	50 468 » »
1916	1 982 385 » »	243 678 » »	70 233 » »
1917	2 584 287 » »	166 358 » »	75 861 » »
1918	2 490 760 » »	143 455 » »	45 244 » »
1919	2 271 983 » »	378 731 » »	79 189 » »
1920	4 103 982 » »	1 070 012 » »	72 801 » »

* 1 *long ton* = 1016 kg.

yield. Several companies, especially in the Florida and Tennessee phosphate fields, are handling this product. In 1914, the United States Geological Survey, in its annual statistical enquiry, asked producers to state the quantity of crude phosphate sold for direct application to the soil. The total of such returns from the miners however does not represent the total quantity sold for direct agricultural use, for some of the phosphate is sold to grinders who do not report to the Geological Survey.

Nevertheless, the annexed figures may be interesting as suggestive of the trend of the fertiliser business, and as a means of comparing the quantity of phosphate sold for direct application with the total amount of mineral phosphate sold and exported from the United States since 1914.

1204 - **Experimental Researches on the Manufacture of Nitrates by the Biochemical Oxidation of Ammonia, in France.** — BOULLANGER E., in *Annales de l'Institut Pasteur* Vol XXXV, No. 9, pp 575-602. Paris, 1921.

The point of departure of these experiments was MUNTZ and LAINÉ's work on intensive nitrification and the formation of nitrifying beds with a high yield. (*Annales de la Science agronomique*, Series 3, No. 2, 1906).

These two investigators had concluded from their researches :

1) that peat is an excellent medium for bacterial nitrification.

2) that by using peat for the construction of nitrifying beds from which flows a constant supply of ammoniacal liquid, it is possible to nitrify (per day and per cubic metre of peat), 1000 litres of ammonium sulphate solution containing 7.5 gm. of the salt per litre, and also to obtain 5 % or 6 % solutions of calcium nitrate by making a series of similar beds, and allowing the nitrified solutions to pass from one to another, adding each time, as the liquid leaves the preceding nitrifying bed, a fresh dose of ammonium sulphate in the proportion of 7.5. gm. of the salt per litre of liquid.

If these results obtained in the laboratory during a short time, and with simple bell-jars could be obtained upon a large scale and continuously, it would be possible to consider the question of manufacturing by this process large quantities of nitric acid, which according to the figures given above, might amount to some 90 tons of calcium nitrate per hectare and per day.

Experiments in this direction were made by the author in 1917-1918.

In this first memoir he gives a summary of the results of his laboratory experiments.

These were carried out in a desiccator at 28° C., and in 4-litre bell-jars filled, either with fragments of peat or of some other bacteria-supporting material, which was regularly watered by hand with a solution of ammonium sulphate. These bell-jars had been previously sown with active cultures of nitrifying ferments, such as are easily obtained from scoria partially immersed in 100 cm^3 of OMELIANSKI's ammoniacal medium (1) to which had been added a little soil.

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(1) *Archives des Sciences biologiques de Saint-Pétersbourg*, 7, 1899, p. 291. (*Author's note*)

The results obtained led to the following conclusions which define the conditions under which the industrial application of biological nitrification can be attempted.

a) THE CONDITIONS UNDER WHICH THE NITRIFICATION BEDS ARE STARTED, AND THE MAXIMUM VOLUME OF THE DAILY OUTPUT. — The large amount of ammonium sulphate (200 litres per cubic metre of peat per day) used at first paralysed the development of the nitric ferment, which is inhibited by excess of ammonia. Therefore, very small quantities must be employed at the beginning. The peat should be watered per cubic metre and per day with 20 to 40 litres of solution only containing 2.5 gm. ammonium sulphate per litre, in order to allow the nitric ferments to develop in the beds and to prevent the incomplete oxidation of the ammonium and the formation of nitrites.

The amount of the solution can be gradually increased, but must never exceed 200 litres per cubic metre of peat per day, in the case of the solution containing 7.5 gm. of ammonium sulphate per litre, and no preformed calcium nitrate. Larger quantities (300 litres and more), leave a considerable and increasing amount of ammonia unnitrified and it is impossible to continue in this manner.

When the peat was watered with solutions containing, in addition to the 1.5 gm. per litre of ammoniacal nitrogen to be oxidised, 40 to 50 gm. of pre-formed calcium nitrate, the nitrification process was much slower, and it was necessary to reduce the amount of solution to a maximum of 75 to 100 litres per cubic metre of peat per day.

b) THE RIGHT KIND OF AMMONIACAL SALT TO USE. — At the beginning the presence of nitrates greatly hinders the increase of the nitrifying bacteria. The first waterings should be made with a solution of ammonium sulphate, and not of ammonium nitrate, in order gradually to accustom the micro-organisms to the nitrate formed, and to promote their multiplication.

When a sufficient number of bacteria have developed, there is no objection to the use of a solution of ammoniacal nitrate, obtained by dissolving this salt in water, or in the nitrified liquid, or by the double decomposition (by the sulphate or carbonate of ammonia), of the solution of calcium nitrate that has flowed from the nitrifying beds.

The best results are obtained by the application of the solution of ammoniacal nitrate produced by the double decomposition (brought about by the bicarbonate or sesquicarbonate of ammonia) of the solution of calcium nitrate flowing from the nitrifying beds. This double decomposition effected by the ammonium carbonates has also great advantages from the industrial standpoint, viz. the suppression of the calcium sulphate which consequently has not to be separated and removed, the recovery of the calcium which can be returned to the nitrifying beds, the more ready evaporation of the nitrate solutions in the absence of calcium sulphate in solution, etc

c) MAXIMUM NITRATE CONCENTRATION OF THE NITRIFIED SOLUTIONS. — In roderto obtain concentrated solutions of calcium nitrate, it is not necessary to make a series of 8 or 9 similar nitrifying beds and to let the nitrified liquid flow from one to the other, after the addition of the amount of ammonium sulphate necessary to bring the ammoniacal nitrogen content up to 1.5 gm. per litre, and the separation of the precipitated calcium sulphate. This end can be attained more easily by causing the effluent to pass repeatedly through the same nitrifying bed, after adding each time a fresh quantity of ammonium nitrate. The highest concentration the author was able to obtain was 138.2 gm. of calcium nitrate per litre, but this amount gradually checks the nitrification process. Regular oxidation of the ammonia could however be obtained with a concentration of 120 gm. of calcium nitrate per litre.

For industrial purposes, a method similar to that employed in vinegar factories could be adopted with advantage. When the nitrifying beds are in full working and contain enough calcium nitrate to produce a nitrifying liquid with about 21.5 gm. of nitric nitrogen per litre (or 12 % of calcium nitrate), a portion of this nitrified liquid is removed, the rest being returned to the bed. To the portion removed are added water and ammonium carbonate in sufficient quantities to produce a solution containing 20 gm. of nitric nitrogem, and 1.5 gm. of ammoniacal nitrogen per litre; it is then again passed through the nitrifying bed. After its passage, this solution gives (owing to the slight concentration due to evaporation), a liquid containing about 21.5 gm. of nitric nitrogen per litre, the amount of the output being from 50 to 75 litres per cubic metre of the substratum per day. In this way there is one solution only for watering the peat, and all the nitrifying beds work under similar conditions.

d) EXPERIMENTS WITH DIFFERENT MATERIALS FOR THE NITRIFYING BEDS. — The use of peat for beds discharging nitrate solutions has many inconveniences from the standpoint of industrial work on a large scale. Peat is not homogeneous in structure, is difficult to crush and crumbles a great deal when kept. Further, the presence of organic matter causes some initial loss of nitrogen owing to denitrification, and gives rise to highly-coloured solutions of calcium nitrate, while the progressive disintegration of the fragments of peat etc. induces warping.

Peat can well be replaced by pozzolana, a very fine porous volcanic scoria, which when used in pieces the size of a cherry-stone, gives excellent results, superior to those obtained with peat.

1205 – **Experiments with Zenonite as a Manganic Fertiliser. in Italy,** (1). CAUDA, A., in *Il Coltivatore*, Year 67, No. 26, pp 243-245. Casale Monferrato, September 2[illegible], 1921.

The author first deals with the effect of manganic fertilisers in general and then describes his manurial experiments with zenonite.

The idea of using manganese dioxide as a fertiliser originated in the frequent need experienced by plants of finding oxygen at their disposal when growing on badly aerated soil, or at seasons when it is difficult to work the ground, and especially when it is a question of replenishing the lower strata of the soil with substances that easily yield free oxygen. Numerous successful experiments were made in digging in manganese dioxide to a considerable depth, the growth of the underground portions of the plants being increased by this treatment. This application of dioxide of manganese was termed *oxygenic fertilisation.*

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(1) A silico-manganiferous mineral taking its name from Monte Zenone, (Liguria, Italy). It is put on the market by the "Mineraria Italiana," Genoa, Via XX Settembre 3-17. According to the statement of the Firm, zenonite contains: 45-50 % dioxide of manganese — 3 % oxide of iron — 5 % calcium oxide — 0.5 % phosphorus — 37-42 % silica.

The experiments carried out by the author on the elongation of roots under the chemostatic action of manganese compounds, as compared with the effect of other salts, have shown the superiority of manganese dioxide in this respect, even in comparison with sodium nitrate.

It was found that plants with fleshy tubers or roots, such as potatoes, the *Liliaceae* etc., benefit greatly by deep treatment with manganese.

Other compounds of manganese, such as the chloride, carbonate and sulphate, were recommended and used advantageously as fertilisers. In almost every case manganese chloride, a salt that diffuses very readily, produced an increase in the yield.

The plant has no real need to use manganese as a food and hence the compounds of this metal do not act directly, but as catalysers, or rather as solvents. In fact, they gave good results whenever they were associated with other nutrient substances which form essential elements of the plants, food supply.

Dioxide of manganese not only plays an active part, in so far as it liberates oxygen, but also, on being transformed into manganic acid, it serves as a solvent for the otherwise insoluble substances present in the soil and thus acts as a potent agent for their removal. Potassium, calcium and magnesia are all rendered soluble by manganic compounds. Recent experiments have shown that the potash of leucite is rendered more easy of assimilation by the simultaneous application of manganese dioxide.

It is also well known, that certain important bacterial processes in the soil are rendered more intense and rapid by the presence of manganese; such for example is the case as regards nitrification, although the denitrification of the organic matter is hindered by the manganese.

Taken as a whole, the results of these experiments prove, that manganic fertilisers should be employed where there are reserves of substances requiring to be dissolved and quickly put into circulation, but if there is no such accumulation, manganese may hinder the development of the plant and retard the growth, especially of the green organs.

Certain plants derive benefit from a manganic fertiliser, while others do not, clover belonging to the latter class and white mustard to the former. In the case of cereals, the weight of the grain, but not always that of the straw, is increased by manganese.

Thus the application of dioxide of manganese as a fertiliser can be generally recommended as a useful adjunct for rich soil, or as a means of utilising the potassic reserves present in the soil. It may also be good for rice fields and " marcita ".

Manganic fertilisers are not more used because there is considerable uncertainty as to their application, a question needing many experiments: further these compounds are rare and expensive. They can, however, be replaced by soil from manganese-bearing deposits, which are by no means uncommon in Italy. Zenonite, which contains up to 45 % of the dioxide, makes an excellent substitute for pure manganese compounds.

A manganic fertiliser could be used with advantage for:

calcareous and magnesian soils;
leucitic, volcanic and felspathic soils;
soils rich in organic matter;
damp, poorly-aerated soils;
white, cold soils.

In other cases, it is possible that the addition of manganese would not increase the crop as much as other fertilising substances.

The addition of fertilisers to soil has sometimes the effect of causing the crop to develop late, such substances having a depressing effect upon the plants and retarding their growth. After a time however the plants grow more luxuriantly, the weight of the crop is increased and sometimes, the yield is larger than in the untreated fields. Such fertilisers should therefore be applied at the right date, some time before sowing, and with due regards to the general conditions of the environment (light, heat, damp).

Zenonite is a dark-coffee coloured powder with high specific gravity.

If applied at the time of sowing to haricot beans in pots with calcareous soil in which potatoes have been previously grown, it gives satisfactory results. In each pot, which is 21 cm. high, and 21 cm. in diametre, 40 gm. of zenonite are spread in two layers (one at some depth and the other near the surface), at the time of planting the seeds.

	Date of sowing Aug. 16, 1921	
	with zenonite	control without zenonite
Height of beans on Sept 5, 1921	15 cm.	20 cm.
Colour of leaves	light-green	dark-green
Appearance of leaf blade	extended	curled over at the edges

Later, the difference in height was less accentuated, and the height and lateral development of the beans fertilised with zenonite was greater than in the case of the control plants

1206 - **Contribution to the Study of Wheat Scald. — Researches on the Physical, Chemical and Agricultural Characters of the Grain, in Italy.** — DRAGHETTI A., (Forlì R. Laboratorio autonomo di Chimica Agraria), in *Le Stazioni Sperimentali Agrarie Italiane*, Vol LIV, pp 257-277. Bibliography. Modena, 1921.

The author reminds his readers that the actual composition and external appearance of wheat kernels alter considerably according to different conditions of climate, soil and cultivation; this is clearly shown by the phenomenon of scald, which is due to great heat and drought overtaking the crops before they are ripe, and does most harm to relatively late maturing varieties. The author mentions some data obtained respecting the yield of 22 kinds of wheat grown in a comparative acclimatisation experiment at the Experiment Farm of the " R. Laboratorio di Chimica Agraria " at Forlì, during two consecutive, but entirely different, years; one 1919, being nearly normal, and the other, 1920, exceptionally hot and dry during the spring months, the most important for the growth of cereals. Hence the interest of the data quoted, for they probably represent the greatest variations in the character of wheat kernels that can be attributed to meteorological conditions, and allow the following conclusions to be drawn.

The 1920 crop, compared with that of 1919, is characterised by: 1) lower germination, and a less degree of purity, the average percentages being respectively 5 and 4; the germinative property is similarly changed; 2) the lower weight of the individual grains in the case of all the late varieties, although the grain of the early and of some of the fairly early wheats, such as the Rieti Fam. 11, the Cervari, and the Sicilian Toselli was heavier, owing to their not being susceptible in the same degree to scald; 3) lower specific gravity of all the kinds except Rieti Fam. 11, and the non-lodging, half awned Fam. 96, although their kernels were smaller; 4) a certain irregularity in the size of the kernels, which in 1920 was generally greater in the case of the earliest varieties, less in the late ones, and almost equal in the moderately early kinds; 5) a high nitrogen and crude protein content in every case, except Apulia, a very early drought-resisting variety with normal grain; 6) the soluble nitrogen content does not appear to be affected by the stunting of the grain, for in some varieties it was equal or even higher, although all the other characters had been much altered

As regards the behaviour of the soft grain and the hard grain during these two years, it may be mentioned that: 1) the proportion of hard grains was highest (taking the entire harvest) in 1920; although the two hard Cologne varieties formed an exception to this rule, their hard kernels having greatly decreased in number in 1920; 2) the absolute weight, specific gravity and nitrogen content of the hard kernels varied within rather narrow limits whereas these characters showed considerable differences during these two years in the case of the soft kernels; 3) in consequence, while in 1919 the hard kernels were richer in nitrogen than the soft kernels of the same year, the reverse occurred in 1920; therefore the statement that hard kernels have always a larger nitrogen content than soft, is only true as regards wheats that have grown and ripened normally.

Plant and Culm

No. OF VARIETY LINE OR HYBRID	PLANT				CULM						
	Weight gm	Well developed culm	Weight of culm	Observations	Type	length in cm		No. of internodes	Diameter of lowest node	Quality of culm 1 = good 3 = bad	Observations
						without ear	including ear				

Ear and Kernels

EAR							KERNELS						
Weight in gm	No of nodes of rachis	No of atrophied or badly-developed spikelets	No of well developed spikelets	D = density of ear	P = productive value	% of husk and awns	Weight gm	No of kernels	Weight of 1000 kernels	% of kernels	Other observations	Quality	General notes special notes on the plot and on the different characters of each plant

What has already been said justifies the statement that good grain for bread-making is almost always characterised by the quality of soft kernels, the influence of the hard kernels depending solely upon the proportion in which they are present in the mass. This proportion is very variable from one season to another, but is much influenced by good cultivation and the improvement of the variety by selection.

As regards the effect of the conditions under which the plant has grown upon the physical and chemical characters of the kernels it must further be conceded that hard grains are a more highly evolved and persistent type, chiefly perhaps, on account of the position of the ear, which allows such kernels to develop more easily, even when the environment is not favourable to the parent plant.

1207 – **Organisation and Development of the "La Estanzuela" Phytotechnical Institute (Uruguay) for National Seed Production and Wheat Selection.** — I. BARRIOLA, P. J., in *Revista de la Asociación Rural del Uruguay* Year I, No. 5, pp 397-401, 4 figs. — II. DELLA ZOPPA J. G., *Ibidem*, pp. 393-396, 3 figs. — III. FISCHER G., *Ibidem*, pp. 386-392, 4 figs. Montevideo, May 1921.

I-II. — The Institute known as "La Estanzuela" is divided into two sections: the Phytotechnical Institute and the Seed Service ("Semillero Nacional"), one being complementary to the other.

The work of the Phytotechnical Institute chiefly consists in scientific and technical researches, undertaken with the view of obtaining selected seed and creating new types especially adapted to the different physiographical zones. It also includes the introduction, testing and acclimatisation of agricultural and forage plants. The personnel consist of the Director, assisted by two agricultural-engineers, a cultivator, laboratory assistant, and a staff of agricultural workers.

The seed service is entrusted with the general administration of the establishment, the breeding on a large scale of the types obtained by selection, the direction of the progeny fields on the farms set apart for breeding purposes and finally, the classification and sale of the products of selection.

The work is directed by an agricultural-engineer with the help of an expert, a chief cultivator and a staff of agricultural workers and labourers.

The land under the management of the Institute (418 hectares), is divided as follows: Experiment field No. 1: 3 hectares — Experiment field No. 2: 10 hectares — Experimental Rotation field: 10 hectares — Farms for seed breeding and the cultivation of forage plants etc. 250 hectares — Cattle enclosure: 90 hectares.

The remaining 55 hectares consist of the area occupied by buildings, threshing-floors, roads, etc.

In addition to the central building in which are installed the laboratory, museum and administrative offices, there are also a large granary for cereals, and a barn for keeping maize in the cob with a capacity of 60 000 kg.

The Institute also possesses a complete stock of agricultural machines, a herd of cattle, numerous draught-horses, a stock motor-plough and a complete equipment of graded sieves for the mechanical sorting of seeds.

The laboratory is provided with all the necessary apparatus for research work (genetic, botanical and chemical), while the experiment field is well supplied with the nets and isolation cages necessary for selection and hybridisation.

On page 1528 is reproduced one of the forms used at the Station for the registration of wheat selection returns.

III. — Hitherto, the most interesting results have been obtained from the work on wheat selection.

Some pure lines of distinct types have already been ontained, such as *Americano* 26*n* *Americano* 44*d*, *Pelon* 33*c*, and *Duro* 45*b*, which have retained for a considerable period their special characters combined with high yield.

Among the hybrids obtained by crossing these pure lines, the results of the cross (cross III) between *Americano* 26 *n* (♀) and *Americano* 25 *e* (♂) deserve special mention.

The data collected during the period 1919-1921 bring out very clearly the increased fertility of the hybrid (the figures refer to 3 of the best families), as compared with that of their two parents (See Table below).

Yield (in quintals) of grain per hectare of Cross III and of its parents

	1918-1919	1919-1920	1920-1921
Americano 26 n (♀)	14.1	15.6	11.1
Americano 15 e (♂)	10.7	13.8	9.4
» III a	19.4	—	—
» III a 2	—	17.3	—
» III a 21	—	—	17.7
» III b e	20.0	—	—
» III b e 2	—	14.4	—
» III b e 21	—	—	16.3
» III b u	21.4	—	—
» III b u 3	—	14.3	—
» III b u 31	—	—	11.6

Numerous crosses were carried out in 1919, especially, *Americano* 44 *d* × *Pelón* 29 *k* and *Duro* 106 *d* × *Pelón e*. In the F_1 hybrids, are found characters intermediate between those of the two parents, Pelón (awnless) being however predominant as regards awn development; in fact, the hybrids are either quite awnless or have short awns near the tip only.

1208 – **Sterility in Wheat Hybrids.** — SAX KARL, in *Genetics*, Vol. 6, No. 4, pp. 399-416. Baltimore, July 1921.

Partial or complete sterility is of frequent occurrence in crosses between distinct species. Within the same genus certain species are sterile when crossed, while other combinations are completely fertile. Partial sterility may cause the elimination of certain classes of gametes and prevent desired re-combinations of characters in the generation. Sterility may also occasion abnormal vegetative development. It is therefore desirable to determine the sterility relations of the species of economic genera.

The present study is concerned with the genus *Triticum*, and deals with the following points: 1) the endosperm development in fertile and sterile crosses — 2) hybrid vigour (heterosis) in fertile and partially sterile hybrids respectively — 3) lethal factors in wheat crosses — 4) sterility in the F_1 hybrids — 5) size of pollen grains in parents and hybrids.

The following species of wheat were used in this study.

Triticum vulgare:
  1) Pacific Coast Bluestem (of Australian origin);
  2) Amby (awnless wheat from Australia);
  3) Marquis.
Triticum compactum:
  1) Washington Hybrid 143 (from White Track × Little Club 1898)).
Triticum durum:
  1) Kubanka (Russia).
Triticum turgidum compositum:
  1) Alaska (bearded, with branching head).
Triticum polonicum:
  1) Polish.
Triticum monococcum.

As regards the possibility of reciprocal crosses, these species can be divided into 3 groups:

a) *monococcum* group: *T. monococcum*;
b) *dicoccum* group: *T. dicoccum*, *T. durum*, *T. turgidum*, *T. polonicum*;
c) *vulgare* group; *T. Spelta*, *T. vulgare*, *T. compactum*.

In making crosses, only 6 or 8 spikelets were left on an ear, the central flowers being removed. The remaining flowers were emasculated, and the ear wrapped in tissue paper both before and after pollinating, to prevent any access to foreign pollen.

The degree of sterility in the hybrids was determined in 2 ways:

1) The number of grains per spikelet was obtained for parents and F_1 plants.
2) The percentage of sterile pollen was determined (the anthers were detached and the pollen shaken out on a slide smeared with a fixative, a drop of lactic acid was added, and the preparation covered and sealed with Canada balsam).

I. THE F_1 ENDOSPERM IN FERTILE AND STERILE HYBRIDS. — The endosperm resulting from the immediate cross (that is to say, the endosperm developing in the fruit of the female parent), contains, on account of double fertilisation, chromosomes contributed by both parents. In wheat, the embryosac is derived from a single megaspore (one of the 4 resulting from the reduction division), and contains the haploid number of chromosomes. In the same way, the egg nucleus and the two polar nuclei also contain haploid chromosomes. The grain resulting from the immediate cross will be called the F_1 *grain* and the endosperm, the F_1 *endosperm*. The F_1

grain contains the embryo of the F_1 plant. The grains borne on the F_1 plant will be designated F_2 grains, and the endosperm, the F_2 endosperm; these grains contain the embryo of the F_2 hybrid.

When the hybrid grains (F_1 endosperm) were examined, it was found that all combinations which later proved to be partially sterile, had small wrinkled grains, while the fertile combinations had well developed grains often larger than those of the *female* parent.

These biometric data fully confirmed what has been said above.

II. — HYBRID VIGOUR (HETEROSIS) IN FERTILE AND PARTIALLY STERILE CROSSES. — The F_1 plants of the fertile and the partially sterile hybrids are taller than the parents. The fertile F_1 hybrids resulting from crosses of species in the *dicoccum* group are slightly taller than the average of the parents.

Parents		Sterile Crosses		Fertile Crosses	
Kubanka .	39.9	Bluestem × Kubanka . .	23.3	Bluestem × Amby . . .	51.6
Alaska . .	25.3	Kubanka × Bluestem . .	26.4	Amby × Bluestem . . .	31.7
Bluestem .	29.8	Bluestem × Alaska . .	23.1	Bluestem × Hybrid 143	53.5
Amby . .	38.6	Alaska × Bluestem . . .	22.5	Hybrid 143 × Bluestem	20.1
Hybrid 143	16.6	Kubanka × Amby . .	26.5	Amby × Hybrid 143 . .	43.0
Polish . .	39.1	Amby × Kubanka . . .	16.5	Hybrid 143 × Amby . .	29.2
Marquis .	28.8	Kubanka × Hybrid 143 .	29.7	Marquis × Amby	33.6
		Hybrid 143 × Kubanka .	15.7	Marquis × Hybrid 143 .	30.3
		Alaska × Amby . . .	24.8	Kubanka × Alaska . . .	48.2
		Amby × Alaska . . .	18.2	Alaska × Kubanka . . .	34.4
		Alaska × Hybrid 143 . .	25.4	Kubanka × Polish . . .	42.0
		Hybrid 143 × Alaska . .	14.6		
		Polish × Hybrid 143 . .	22.2		
		Hybrid 143 × Polish . .	17.4		
		Marquis × Kubanka . .	22.0		
		Marquis × Alaska . . .	18.5		
		Marquis × Polish	19.2		

The fertile crosses between *T. vulgare* and *T. compactum* result in F_1 plants, which are on an average, 7.3 ± 1.8 cm. taller than the average of the parents.

The F_1 plants resulting from crosses of members of the *vulgare* group and the *dicoccum* group are partially sterile. The height of these plants is however 10.5 ± 1.1. cm. greater than the average of the parent groups. 5 plants only of Alaska × *T. monococcum* were grown but though these F_1 hybrids were totally sterile, their height greatly exceeded that of their parents: 129.5 ± 2.8 cm., whereas the average height of Alaska was 102.3 ± 1.1 and that of *T. monococcum* 87.0 ± 1 cm., there being a difference of 34.8 ± 3.0 cms in favour of the hybrid.

It is thus evident that partially or completely sterile F_1 plants are often superior to the parents in vegetative vigour, even though they originate from small wrinkled seeds.

III. — LETHAL FACTORS IN WHEAT CROSSES. — The F_1 hybrids of the Bluestem × Amby cross (both members of the *vulgare* group), developed regularly till they reached the height of 15-20 cm. They then began to tiller excessively, as many as 40 or 50 primary culms being formed but in no case did a true culm develop. This unusual growth is probably due to lethal factors that prevented the development of the plant beyond a certain stage.

IV. — DEGREE OF STERILITY IN THE F_1 HYBRIDS. — This was determined by counting the pollen grains and the grains set per spikelet. With two exceptions, the grains set per spikelet on the parent plants ranged from 1.85 to 2.91. In the case of Hybrid 143, the number was unusually low, 1.49, which was due to late maturity and unfavourable climatic conditions, whereas the 0.97 of *Monococcum* represent a very high figure, as it normally sets only one grain per spikelet.

In the partially sterile crosses (*dicoccum* × *vulgare*), the number of grains set varies from 0.45 to 1.92; the hybrid *Alaska* × *monococcum* is completely sterile, producing no grain, but the fertile hybrids set more seed than their parents, viz from 2.43 to 3.64. Similar conditions are also observed as regards the percentage of the abortive pollen; from 0.3 (*monococcum*), to 1.9 (Kubanka) in the case of the parents, and from 11.5 (Kubanka × Marquis) to 21.5 (Kubanka × Bluestem) for partially sterile hybrids (97.7 for *Alaska* × *monococcum* completely sterile) whereas the amount of abortive pollen in the case of the fertile hybrids is almost the same as for their parents (0.4 for Bluestem × Hybrid 143, and 1.2 for Kubanka × Polish).

IV. — SIZE OF POLLEN GRAINS IN PARENTS AND HYBRIDS. — The size of the pollen grains differs greatly in the various species. The average volume of the pollen grains expressed in thousands of cubic microns is 72 for *T. monococcum*, 94 for Kubanka and Alaska (*dicoccum* group) and 144 for Marquis and Hybrid 143 (*vulgare* group).

TABLE II. — *Diameter of Pollen Grains in Microns*

Kubanka	55.6 µ	Alaska × *T. monococcum* (*p*)	39.7 µ
Marquis × Kubanka (*n.*)	63.1 »	*T. monococcum*	51.5 »
Marquis × Kubanka (*p.*)	48.6 »	Hybrid 143	60.1 »
Kubanka × Marquis (*n.*)	53.7 »	Alaska × Kubanka (*n.*)	57.0 »
Marquis	60.3 »	Hybrid 143 × Alaska. (*n*)	56.9 »
Alaska	57.1 »	Kubanka × Bluestem (*n.*)	57.3 »

(*n.*) = normal grains — (*p.*) = poor grains.

The variability in size of pollen grains is greater in both the fertile and partially sterile F_1, hybrids than in the parents. In the partially sterile hybrids all degrees of compatible and incompatible combinations are probably present in the pollen grains. The pollen grains of the F_1 plant contain the haploid number of chromosomes contributed by both parents. We may assume that some combinations are unable to function and the pollen grains abort at an early stage in development. Other combinations are able to function more or less favourably, resulting in apparently good pollen grains of varying sizes. In the fertile hybrids, and to some extent in the partially sterile hybrids, the increased variation in the size of the pollen grains may be attributed to differences in growth factors, resulting from various combinations of maternal and paternal chromosomes. Here we have a case of variation in the haploid generation due presumably to different combinations of non-homologous maternal and paternal chomosomes.

1209 – **White Sheath, a Transmissible Character of Maize.** — KIMPTON, J. H., in *The Journal of Heredity*, Vol. XII, No. 5, pp 224-226. 1 fig Washington, May 1921.

White sheath is a variation in which the leaf-sheaths and husks fail to develop chlorophyll and remain white.

This character appeared simultaneously in two sister progenies of the Pawnee variety obtained by self-pollinating the original strain for 2 years.

In both progenies, the number of plants with white sheaths indicated that the character was a simple Mendelian recessive, the actual numbers being respectively 29 green and 11 white: 30 green and 12 white, according to the ordinary 3: 1 ratio. When these variegated plants are crossed with others having normal sheaths, the F_2 consist exclusively of green-sheathed individuals.

1210 – **A Study of the Segregation of a Quantitative Character in a Cross Between a Pure Line of *Phaseolus* and a Mutant from it.** — LEITCH, J., in *Journal of Genetics* Vol. II, No. 2, pp 183-202, figs. 4. Cambridge, September 1921.

In 1901, Prof. JOHANNSEN obtained from seeds of a variety of *Phascolus vulgaris nana* known as Brown Princess beans, a number of pure lines, one of which, line E, is distinguished by having pure white petals and a yellow-white colour in the rest of the flower, without a tinge of violet. The other lines have a violet tinge, often weak but quite unmistakable.

Line E has twice shown a sudden change in genotypical constitution, without any alteration in the white colour of its flowers. One of the mutants, M (long mutant), is distinguished by the greater length of its seeds. Thus we have:

Original type	Length	12.459	Breadth	9.017	I	72.1
Long Mutant	»	13.564	»	9.137	I	67.4

(I is the length-breadth index).

The question being one of quantitative characters, it is a matter of great interest to determine whether they obey MENDELS' laws.

In order to settle the point, the author crossed E and M, obtaining 3 hybrids producing 62 seeds. Two only of these were discarded, the rest being sown in 6 rows and the resulting crop examined in the autumn of 1914.

In his biometrical determinations, the author used distribution curves for the length of the seeds, and also a system of dotted charts.

In plotting the curves, the lengths of the seeds were used as abscissae, and the frequency or number of cases, as the ordinates ; in this way, a curve for each of the lines sown could be plotted.

In the charts the lengths are the abscissae, and the indices of length are the ordinates. The length index is obtained by dividing the length (L) by the breadth (b) and expressing the quotient as % $\frac{(L\ \%)}{b}$. Each plant is represented by a point whose coordinates are respectively the average length and index of its seeds. The plotting was done on transparent mm. paper. This gives an immediate picture of the position of every hybrid in relation to the two parent lines.

These biometrical determinations, which were begun in 1914 and continued until 1918, prove that:

1) In the two cases examined, the hybrids between E and M showed no evidence of segregation (intermediate constant form).

2) On the other hand segregation occurred in most cases in : type M + a new type X shorter and broader than E + an intermediate type that again split, while M and X remained constant. In this case, the ratio of non-M plants (E or X) and M plants is as 3 :1.

These results show that immediately the new X type was established, the theory of mutations being due to the loss of a factor or factors cannot be applied to the present case. No system of recombination of factors (cumulative or otherwise) could explain the appearance of a new type with biometrical characters lying outside the limits of the two parents. The difference between E and M must be regarded as a case of positive actual difference, and not as a case of *presence* or *absence* of a factor or factors.

The simplest view seems to be that one factor has been modified in the original pure line, to give the mutation.

Why not more than one factor ?

1) the segregation according to the ratio of 3: 1 confirmed by the 1916 results, and 2) the fact of there being no splitting in the X and M groups seem sufficient indication that one genetic factor only has been altered in E.

1211 - **Sugar Beet Seed Growing in the Rocky Mountain States.** — TRACY, W. W. (Technologist, Office of Sugar Plant Investigations), in *Farmers Bulletin* 1152 *United States Department of Agriculture.* Washington, D. C., October 1020.

The production of sugar beet seed in the United States is now an established and apparently profitable industry in several sections of the country. Development has been most marked in the irrigated sections of Colorado, Montana, Utah and Idaho. The author gives a description of the methods employed in the Rocky Mountain States and the suggestions made refer to operations on a large scale.

Details are given as to the size of roots for seed, time to sow for stecklings (i. e. small roots used for commercial seed production), spacing, preliminary germination tests before planting, tillage, harvesting, silage, threshing and cleaning.

In addition to the commercial production of sugar beet seed the development of new and improved strains of beets is under study and experiments are being made.

1212 - **Trials of Foreign Cereals in Algeria.** — DUCELLIER, L. (Professeur d'Agriculture à l'Ecole de Maison-Carrée), in *Bulletin agricole de l'Algérie-Tunisie-Maroc*, Year 20, No. 10, pp. 218-219. Algiers, October 1921.

The trials of foreign cereals, that had been discontinued from 1915-1918, were resumed during the season 1919-1920, at the Agricultural College of Maison-Carrée (Algiers) (1). The results obtained before the War were not satisfactory as regards most of the varieties tested, which as a rule, showed less resistance to rust, drought and heat than those habitually cultivated in Algeria.

The varieties giving results most similar to those obtained by cultivating the Algerian kinds were as follows:

Red awned Winter wheat — Dubosc Farm Wheat. The latter is known in Orania under the name of "Tuzelles de Descartes"; it much resembles the Red March Bordeaux Wheat and the Provence Red Wheat.

Awned March Wheat — Late Richelle Wheat — Six-rowed Spring Barley — Six-rowed Winter Barley — Russian Barley (known in Algeria as foreign barley), little valued on account of its small, hard grains that are not digestible when fed whole to stock — Imperial Barley of Italy — Chevalier Barley — Princess of Swalöf Barley — Black Carrée Barley — Large awnless Barley of Siberia or Thibet — Small, awnless Barley, or "orge celeste" — White Ligowo Oats — Grey Winter Provence Oats — Oats of Naples, or of the Abruzzi.

The foreign cereals cultivated in Algeria usually make a very fine show when they first begin to grow, from germination until tillering, but subsequently, the effect of the environment is clearly seen in the case of certain varieties, which sometimes only succeed with the greatest trouble in producing some inflorescences, being arrested in their development by rust, or intense heat, according to district. Others continue their evolution but bear poorly-developed and sometimes wrinkled grain of no value. Finally there are a very few varieties, that bear grain suitable for sowing the following season. Amongst these, some have persisted, but they become gradually weaker, and lose all their good qualities at the end of a few years; hence it is necessary to use new seed corn. This is well-known to occur in the case of the Bel-Abbès Tuzelle, or Awnless Odessa Wheat, which is the only variety cultivated on large areas in Algeria. At Maison Carrée, the best results are obtained from Awnless Odessa Wheat after the 2nd generation. Tuzelle de Descartes is chiefly confined to the neighbourhood of Tlemcen, and Bel-Abbès where so far, it seems to have retained its good quality. The other varieties of wheat mentioned above can hardly properly be said to be cultivated, but are met with here and there generally mixed with Awnless Odessa Wheat and Tuzelle de Descartes. Manitoba wheat has been tried in different districts; its grain although almost normal, is still little in request by the corn merchants, or flour export trade of Algeria. A study of the elements composing this mixture would however be of interest

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(1) See *R.* June 1921, pp. 711-718. Original Article by BRUNEL, entitled *L'Institut Agricole d'Algérie*. (*Ed.*)

Barley adapts itself better than the other cereals to the climate of Algeria, especially the five-rowed Russian variety, black barley and awnless barleys. The latter seem not to suffer from the climate of North Africa any more than the Algerian square barley, and they produce good grain. In spite of this, square barley only is cultivated on a large scale in Algeria. The small awnless barley, or Orge celeste, is grown by the natives, who call it " Chair en Nebi, " or Barley of the Prophet. Its grain is but little used, therefore it is cultivated on very small areas only. Amongst the square Algerian barley are to be found some heads of Russian barley (Bel-Abbès), Black barley, the Six-rowed Barley (Sétif) and Escourgeon, but only in very small proportions. The two rowed barleys soon die out owing to different causes, early-ripening, shelling, etc.

As regards oats, none of the foreign varieties have yet proved superior in yield to the Algerian red oat. The Naples variety does not differ in any way from the Algerian oats cultivated in other parts of the East Mediterranean region, Greece, the Archipelago, etc. The grey variety is little represented in Algeria, and only seen mixed with the red Algerian oats. The few grey kernels to be found in consignments of Algerian oats are less fine in quality than those grown in Provence, Poitou and Brittany.

In 1907, the author discovered among the oats of the Algerian Red variety, a white, still undetermined oat, very noticeable on account of the nodes of the culms which are covered with characteristic whitish hairs; the flowers of this variety are sometimes awnless. This oat produces a fine white kernel more slender than that borne by the Red Algerian variety; on the sea-coast, it appears more susceptible to rust than the latter.

The same conditions obtain on the High Plateaux, where however it is not rust that prevents the growth of foreign cereals, but heat and drought, for when these set in suddenly, they produce scald which affects most of the foreign crops. The possibilities of acclimatisation are greater in some of the higher, and more favourable localities such as the neighbourhood of Médéa, Tlemcen, etc.

In trials made during the year 1919-1920, wheat varieties or hybrids, from the Mediterranean region were chiefly tested. SCHRIBAUX, Director of the Seed Station at Paris, sent to the author 22 fine varieties obtained either by himself, or by STRAMPELLI, Director of the Cereal Cultivation Experiment Station at Rieti, or by F. TODARO, Professor of the University of Bologna. These wheats were sown on December 31, 1919, a little late, in the experiment field of the School of Agriculture at Maison

Carrée, in siliceous clay soil, well prepared by a crop of spring mangels, and in excellent conditions as regards moisture and temperature.

Fertilisers: 300 kg, of 16/18 superphosphate dug in by a gang plough followed by a pulveriser.

Sown in rows 33 cm apart (1).

Thanks to the temperature, which kept relatively high after sowing, and also to the moisture of the soil, the seeds came up very regularly, generally within 12 days after sowing, except in the case of one variety of wheat, Bobs, which took as long as 14 days. This is probably due to the present character of the variety, which is not homogeneous, being composed of 3 kinds of wheat, which are identical as regards shape and size of grain, but differ in growth and character of ear.

The growth of these varieties, on account of the progressive rise in temperature, was only slightly checked after the seed came up, and in the first fortnight of February, tillering was practically finished. At this time all the stools were regular and entirely covered the ground. It is stated that the leaves of these varieties were generally smaller than those of the varieties which have adapted themselves to the climate of Algeria.

Rust suddenly made its appearance on all the wheats during the second fortnight in April; in some cases the lower leaves were almost destroyed by the parasite. The sorts that suffered were chiefly:

Square-eared Wheat × Krelot — Bologna Wheat No. 38 — Rieti Wheat × Japhet A 1 — Bologna Wheat No. 96 — Rieti Wheat × Japhet A 3.

The following were also attacked, but to a less extent:

Rieti Wheat × Awned Japhet — Bologna Wheat No. 48 — Early Saunders Russian Wheat — Bologna Wheat No. 12 — Fédération Wheat — Carlotta Strampelli — Bologna Wheat, No. 33 — Aurora — Bologna No 8 — Bologna No. 1 — Bologna No. 20 — Rieti Wheat.

The effect of rust has not yet been determined as regards the Bobs and Manitoba wheats, which are populations including many varieties or kinds, some of which appear likely to be useful in Algeria.

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(1) This space between the rows has been adopted in the case of the experiments made at Maison-Carrée as the result of various trials begun in 1908. Of all the different methods adopted (sowing in rows from 20 to 80 cm. apart), none has, so far, proved better or more practical than that of leaving a space of 25 to 35 cm. between the lines, whether as regards the utilisation of the soil by the plants, tillage, or quality and crop yield. The ground of the experiment field was hoed twice, at suitable times, between the germination of the seed and the moment when the cereals cover the soil with their leaves, thus forming a screen, after which they resist drought better. The crops are only harrowed once, the time selected being more or less suitable and before the growth period; this single operation is quite insufficient in Algeria, especially in dry years, when the rainy periods occur at long intervals, and the rainfall is very small. The same observation was made at Sétif (see: A. CHOLLET, La culture sarclée des blés, in *Revue agricole*, Sept. 3, 1920), and in other parts of Algeria (Orania). On the other hand, the spaces left between the rows must not be excessive, for DUCELLIER has found that cereals sown widely apart are more severely attacked by rust than those seeded broadcast. (*Author's Note*)

[1212]

In this experiment, it was again found that the injury caused by rust did not appear to bear any strict relation to the severity of the attacks. The size of the spots, and their position, seem to acquire special importance when these patches occur in large numbers on the sheath, lower portion of the leaf blade, or the upper part of the culm. In this last case, it seems clear that the migration of the substances elaborated by the leaves was considerably interrupted, for some patches covered nearly the whole width of the sheaths or base of the leaves Special experiments should however be made to prove this.

The rust attack was less intense during the last agricultural season, which was particularly dry, than in wet years and the upper leaves of some varieties of wheat were able partially to fulfil their functions.

As drought supervened upon rust, their combined effect hindered the development of some already very weak varieties such as:

Bologna Wheat No. 38 — Rieti Wheat Japhet A 3 — Square eared Wheat Krelof — Carlotta Strampelli — Rieti Japhet A 1 — Bologna No. 6 — Bologna No. 11 — Bologna No. 96.

The monthly rainfall at Maison-Carrée from September 1919 to June 1920, was respectively (in millimetres): 48-71-29-81-24-70-62-16-13-23; total 437. There was thus but little moisture in the soil and as a rule only the surface was damp.

The rain of September and of the first fortnight in October had no effect upon the soil moisture, evaporation being complete. The May, rains, although more plentiful, were of no benefit to the Maison-Carrée cereals on account of their stage of development. The June rains fell at the end of the harvest.

The amount of water therefore at Maison Carrée that could actually be turned to account, was only about 300 mm., a deficit of nearly 200 mm. on the mean registered rainfall, the average annual rainfall being 500 mm.

This deficit was the more serious on account of the small amount of rain that had fallen in January and April; the light falls of these months having been frequently preceded or followed by drying winds or periods of high temperature.

The hot dry period lasting from May 9-14)(25° C to 35° C), was most injurious to the varieties under trial at Maison Carrée, the growth in most cases being suddenly arrested.

Flowering took place during the second half of April, and in the case of all the varieties (except Bobs which had 3 fertile flowers) the two lower flowers of the spikelet set and produced two seeds

The varieties that did best were:

Bobs Wheat Bologna No. 12 — Early Russian Saunders Wheat — Aurora — Rieti × Awned Japhet Bologna No. 91 — Bologna No. 33 — Bologna No. 16 — Marquis.

They ripened early (end of May), for there was no great difference beween the time each variety matured, although in a normal year, it would have been at least twenty days before all the wheats reached maturity. This therefore must be regarded (except in the case of Bobs) as an abrupt cessation of growth, rather than as the normal close of the vegetative period. The grain produced by Bobs was very similar to that used for seed-corn.

The grain of Bologna No. 12 was also very like the seed planted but rather narrower.

All the other wheats gave a smaller grain, usually of slightly darker colour than the samples. Their appearance leaves much to be desired from the Algerian commercial standpoint, for preference is given to the supple, fine, white or yellow wheats which, as a rule, prove the hardiest in Algeria.

The grain and straw returns obtained are as follows (in kg. per hectare): Manitoba, 440; 3600 — Rieti, 850; 4720 — Early Russian Saunders 940; 4060 — Carlotta Strampelli 450; 3730 — Bologna No. 12, 650; 2600 — Bologna No. 11, 300; 1650 — Bologna No. 1, 800; 4300 — Bobs, 1100; 2860 — Bologna, No. 29, 850; 2450 — Fédération, 900; 3750 — Aurora 1420; 4970 — Rieti × Awned Japhet, Hyb. Station 1100; 4460 — Bologna No. 91, 1300; 4260 — Bologna No. 33, 1280; 3380 — Bologna No. 8, 250; 2050 — Marquis, 920; 4080 — Bologna, No. 48, 900; 2950 — pedigree kinds obtained at Maison-Carrée: Mahon, No. 17, 1570; 5230 — Mahon No. 49, 1920; 7320 — Mahon No. 2,2250; 8050 — Mahon No. 10, 2500; 8500 — Mahon No. 15, 2950; 9420 — Mahon, No 28, 3050; 1050. These kinds were as a rule little attacked by rust and yielded grain of average or good quality.

The wheats, Bologna No. 38, Rieti × Japhet A 3 Station, Bologna No. 90, Epi Carré × Krelof Hyb. Station, Rieti × Japhet A, Hyb. Station were not able to set any grain.

As regards rust resistance and the quality of the grain, the following observations have been made.

Manitoba: patches of rust on culms and sheaths, more numerous usually on the leaf-blades. Mixed variety: 1) with red awnless ear, kernels red, short; 2) awned red ear, grain short, very small; 3) white awnless ear, grain red, short. Small grain of marketable quality

Rieti: sheaths little affected by rust, leaf-blades more attacked. Grain wrinkled, quality inferior.

Early Russian Saunders: Numerous patches of rust in sheath and blade of upper leaves. Grain a little wrinkled, of average quality.

Carlotta Strampelli: Traces of rust on the sheaths, more on the leaf-blades. Scalded. Grain of inferior quality, much wrinkled, irregular.

Bologna No. 12: Rusted on culms, sheath and leaf-blades. Large grain of good quality, pure variety bears 6-7 infertile spikelets at the base of the ear.

Bologna No. 11: Traces of rust. Grain of inferior quality.

Bologna No. 1: Little rust on culms and sheaths, more on leaf-blade: 6-7 infertile spikelets per ear. Grain wrinkled, irregular, quality below the average.

Bobs: irregular growth. Mixture formed of several varieties: 1) ear white and yellowish, awned, grain short and yellowish; 2) ear red, semi-awned, grain short; 3) ear yellowish or reddish, awnless, grain short, yellowish. The 3rd variety is less attacked by rust than the others. Grain of good quality.

Bologna No. 29: Like Bologna No. 12, except that the quality of the grain is inferior.

Fédération: Leaf-blades much rusted. Traces of rust on the sheaths Half-scalded. Grain of inferior quality, scarcely marketable.

Aurora: Has a few patches of rust on the culms, but more at the base of the sheaths and on the leaf-blades. Grain of average quality, homogeneous.

Rieti × *Japhet*: Irregularly attacked by rust at the base of the sheath and of the leaf-blade. Large grain of average quality.

Bologna No. 91: Little rust on the sheaths, more on the leaf-blades. Large grain, quality scarcely average, homogeneous.

Bologna No. 33: Irregularly marked with rust. Grain short, homogeneous, quality below the average.

Bologna No. 8: Rust on sheaths and blades of upper leaves. Grain homogeneous, of very inferior quality. This variety suffers greatly from drought.

Marquis: blade of leaf attacked by rust, sheaths and culms little affected. Grain short, small, average quality, homogeneous.

Bologna No. 48: Much rusted at base of sheaths and leaf-blades Some individuals suffer more than others. Grain homogeneous, wrinkled, quality scarcely average.

If classified according to yield, which varies from 250 to 1250 kg. per hectare, these wheats come below the Algerian varieties grown on the same soil, the yield of the latter being between 1970 and 3050 kg. per hectare. The comparison of the yields, is however only given as a guide and to show the effect of early sowing in Algeria.

The sowing of the Algerian varieties in the experiment field belonging to the College was finished by the end of November. The difference of one month between the dates of seeding would partially explain the differences reported between the yields of the European and African wheats

Some other varieties of cereals were also tested, such as: Pétanielle de Nice, Awned Blé de Mars, Blé hybride des Alliés, Chevalier barley, Princess of Swalöf Barley, White Ligowo Oats, Grey Houdan Oats, Black Hungarian Oats. Negative results were obtained in the case of: Pétanielle de Nice; Blé Hybride des Alliés, Houdan Oats, and Black Hungarian Oats.

The condition of the European varieties during growth, their yield, and the quality of their grain justify the following conclusions.

They are less drought resistant than the local varieties.

Their period of winter repose is longer than that of the African varieties.

They grow more slowly and, as a rule, their vital processes slacken as soon as the heat begins in April or May.

Their rust resistance is inferior, owing to some extent to their mode of growth.

The grain ripens more slowly.

[1212]

These conclusions corroborate in the main those previously made at Maison-Carrée respecting the chief European and other varieties. Therefore fairly early wheats only give the best results in Algeria. The very early sorts, as for instance those from the Sahara, do not suceed better than the former, are destroyed by rust, or else by damp, which makes them shed nearly all their flowers, while the latter are checked in development by drought or rust according to district. Sahara wheats sown in December have headed in February-March, but the flowers were not fertilised. Early Lapland barley planted on December 5, continued to head from February 21 to April 15 without giving any results.

On account of the meteorological conditions of the year 1919-1920 which were unfortunately most unfavourable to cereals throughout Algeria, and prevented a complete valuation of the varieties tested, the most productive varieties will be grown again for the purpose of comparing them with the wheats that have been selected at the College.

1213 - **Experiments in Treating Wheat Grain by Immersion in Nutrient Solutions, in Italy.** — D'IPPOLITO, G. (Modena, R. Stazione agraria), in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. LIV, Parts 7, 8, 9, 10, pp. 218-256 Modena, 1921

Experiments in treating wheat grain with solutions of different salts at varying degrees of concentration: some of the solutions used are known for their power as fertilizers and their effect as stimulants. These experiments were carried out in earthen boxes (29 wheat seeds being planted in parallel rows in each), they were continued until the 21st day, by which time, the seedlings were about 20 cm. high. The seeds were treated in 3 series: 1) for 6 hours with 5 % solutions of respectively calcium phosphate, potassium, sodium, ammonium, and of calcium ammonium, and potassium nitrates and subsequently wih 20 % copper sulphate and quick-lime for 20 minutes. The results were compared with those obtained by immersing the grain for 6 hours in ordinary water, and then in some anticryptogamic substance, like those mentioned above, and were also compared with the results of control experiments. 2) For 1 or 2 hours with 20 % solutions of phosphate of ammonium, calcium, potassium and a 2-5-10 % solution of sulphate of potassium, and also for 5 and 24 hours with these last solutions; they were also given the same anticryptogamic treatment. For purposes of comparison other seeds were heated with ordinary water or left untreated. 3) 1-2-5-24 hours immersion in 0.050-0.10-0.15.0.20-0.30 % solutions of sulphate of manganese (for 5 hours only in the two last solutions). These experiments in boxes were completed by others made in the open on plots of 200 square metres: 1) seed treated with a 5 % solution of calcium nitrate for 6 hours — 2) *id.* of calcium phosphate — 3) *id.* of commercial manganese 3 parts per 1000 for 24 hours. — 4) *id.* pure, 30 parts per 1000; 5) with 4 % potassium sulphate — 6) with ordinary water for 6 hours.

The results of these preliminary laboratory experiments do not justify any conclusions as to the good effect to be obtained from fertilising seed by immersing it in nutrient solutions, for not only did both the nitrates and phosphates fail to produce any noticeable improvement, but the nirates, after a certain point, proved distinctly injurious. Sulphate of potassium however though its fertilising power is inferior to that of the phosphates and nitrates appears to have been of some advantage.

Sulphate of manganese, on the other hand and to some extent ordinary water were very beneficial.

As the open air experiments proved quite satisfactory it may be supposed that the advantages accruing from the immersion of seeds in ordinary water may be due to some special stimulating effect exerted by the latter on cellular activity, manifesting itself later in the stronger development of the root system, and consequently of the whole seedling.

Further the negative results obtained by treatments with phosphates and nitrates disprove the hypothesis that the fertilising substances penetrating by absorption into the seed can afterwards affect the plant at a more advanced stage of growth. It would indeed be impossible to explain why the seedling does not at once use the nutrient elements at its disposal, during the period when it most requires them.

The field experiments finally dispelled all doubts on the subject, for the plants that continued developing with greatest vigour throughout the entire period of growth, and hence gave the best yield, were precisely those that had shown their superiority from the earliest period.

Another important fact was demonstrated by the field experiments viz., that even allowing for the experimental errors always accompanying such tests it was clear that the plots yielding the finest crops were those sown with wheat treated with sulphate of manganese. Since it cannot be supposed that the manganese had a fertilising effect, owing to the small proportions (3 in 1000) in which it was used, it is most probable that it acted as a stimulant. Thus support is given to the new theory put forward by many investigators engaged in the study of the question, namely that manganese plays the part of an active oxidising agent, not only directly but also indirectly transporting oxygen and fixing it in the soil.

In any case the results obtained naturally cannot be regarded as final, and it will be necessary to repeat the experiments under more favourable cultural conditions in the hope of reaching definitive conclusions.

1214 - **Preliminary Classification of the Wild Rices of the Central Provinces and Berar, India.** -- ROY, SUDHIR CHANDRA, in *The Agricultural Journal of India*, Vol. XVIII, Pt. IV, pp. 365-380. Calcutta, July 1921.

Report of investigations as to the character and nature of the wild rices found growing in the "nalas" and waste lands of the Central Provinces and Berar, India. Earlier results dealing with the classification of the cultivated rices are to be found in the *Memoirs of the Department of Agriculture in India* (Botanical Series), Vol. VI, No. 7, Dec. 1913 by R. J. D. GRAHAM. The economic importance of the study of wild rices is evident owing to the fact that heavy losses have been incurred through contamination of the cultivated rices through casual mixture and natural crossing and much trouble has also been caused by the spread of wild rices as a weed.

Seeds of over 100 different samples were obtained from all the districts of the Provinces in question and were sown on the College Farm, Nagpur. In most cases, except where whole ears were available, the samples were found to be mixed in varying proportions of the different types of wild and cultivated rices. By single plant selection, ears of 536 individual plants were collected separately and line cultures were easily obtained.

Occurrence. — Wild rices are to be found on the margins of tanks, rice fields or other marshy or low lying places not actually submerged, but containing enough moisture to carry them through the season.

Characteristic features. — Morphologically there is very little difference between a wild and cultivated rice, but generally speaking the former may be recognised by the spikelets having dark red grains inside, by the presence of long stout awns, red, scarlet or green in colour, and lastly by its characteristic habit of shedding the spikelets in the green stage, long before they appear to have become quite ripe. The ripe grains in many of the varieties were noticed sometimes to develop a peculiar light black or ashy colour, here refered to as " wild " type colour. This is a special feature and is not generally found in cultivated rices.

Pollination. — The glumes open out between 8 and 9 a. m. as in cultivated rices but remain open for a longer period (about 1 hour or more), and the anthers do not burst till they get slightly warmed by the heat of the sun for about 2 to 5 minutes. The stigmas come out immediately on the opening of the glumes and remain in that position for some time and in most cases fall over and assume a pendent position. Occasionally dehiscence takes place before falling, but as a rule it does not occur till about 2 to 5 minutes from the opening of the glumes. During this period the chances of cross pollination are certainly considerable and hence apparently the much higher percentage of crossing met with in the wild than in the ordinary cultivated rices when the pollination generally takes place inside the closed glumes, the anthers bursting either before the opening of the glumes or just at the time of opening and thus encouraging self-pollination.

Natural Crossing. — By single plant selection it was found that, though the majority of lines bred true, some showed distinct signs of splitting proving the selected plants to have been heterozygotes. Tables give the results of the F_2 generation of some of the natural crosses obtained in the wild rices during the years 1917 to 1919. The following characters have been found to behave as Mendelian units in the wild rices: — The green or red colouring of the leaf sheath, black or straw colour of the ripe grain and the clustering or non-clustering habit of the spikelets ; of these the characters of the coloured leaf sheath, the ripe black grain and the clustered spikelets have been found to be dominant and segregating characters.

Classification. — An artificial key to all the types collected is given, classified according to colouring of grain with leaf-sheath green and also with leaf sheath red or purple, with a description of 24 different types.

Economic Aspect — The method recommended to eliminate these wild forms from a cultivated rice field is to grow some coloured rice (preferably the purple rice) in the fields which show an abundance of wild rice. This rice, being purple all over, will allow all the green rice plants to be uprooted without any loss, and with careful weeding the land should be quite free from wild rice the following year. Another method which could be adopted as an alternative is to keep the land bare of any crop for 6 to 8 weeks after the starting of the monsoon. Seeds of cultivated rices should be sown in seedbeds known to be free from wild rice and transplanted to the fields where in the meantime the wild rice has grown and been uprooted

1215 - ***Phalaris bolbosa* in the Province of Tucumán, Argentina** (1). — SCHULTZ, E. F., in *Revista Industrial y Agricola de Tucumán*, Vol. XI, Nos 5-6 pp 63-70, 9 figs. Buenos Ayres, October-November 1920.

The Agricultural Engineer, A. Y. BOTTO, Chief of the Agricultural Division of the National University of Buenos-Ayres, has introduced *Phalaris bulbosa* into Argentina, and considers it an excellent forage plant for the coast provinces. It has spread rapidly throughout the coast and central regions where it is grown, especially in winter, as a perennial forage crop.

Phalaris bulbosa has been tested since 1915 at the Tucumán Experimental Station, and is there regarded as being not suited for growing on a large scale in the province, for it is a plant requiring a more temperate climate, free from the sudden and great changes of temperature and more particularly the excessive heat of Tucumán, where the thermometer frequently registers over 45° C. Another cause militating against the success of *Ph. bulbosa* is the drought which usually persists from May to October and is accompanied by great evaporation. Hence this plant can only be grown in the district with the assistance of irrigation, or in soil where the moisture always rises to the height of its roots. Where however irrigation is possible, and the water does not stagnate, lucerne is a more paying crop than *Phalaris bulbosa*.

On soil capable of irrigation *Phalaris bulbosa* produces a regular crop of green forage of good quality, but much inferior in quantity to the amount of lucerne which could have been obtained from the same land, even without irrigation. Thus in 1919, with irrigation and in 4 cuttings, 399 quintals of *Ph. bulbosa* were obtained per hectare, whereas the crop yielded by a contiguous, non-irrigated plot under lucerne amounted in one year to 598 quintals per hectare.

In the district of Tucumán, green forage is scarce, especially during the winter months (May to October), that is to say, at the very time when the cuttings of *Ph. bulbosa* are poorest. The usual custom of sowing from March to May, barley, oats and rye to be used as winter forage is far more profitable as these cereals seldom yield less than 2 good cuttings, with a total crop of 250 quintals per hectare, until they are dried up by the October heat.

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(1) See *R.* Oct. 1915, No. 1036. — For information respecting other varieties of *Phalaris*, see *R* 1914, No 732; *R.* 1915, Nos. 808 and 1036; *R.* 1917, No. 517; *R.* 1919, No. 870, *R* 1920, No. 197.

Naturally, *Ph. bulbosa* produces larger crops, if frequently irrigated Thus at the Tucumán Agricultural Station, one plot of ground yielded: in 1917, with 12 irrigations and 4 cuttings, 440 quintals of grass per hectare, in 1918, with 8 irrigations and 4 cuttings, 349 quintals per hectare; in 1919, with 7 irrigations and 4 cuttings, 399 quintals per hectare, and in 1920 (up to the end of July), with 1 irrigation and 2 cuttings 466 quintals per hectare.

Ph. bulbosa is propagated either by seed, or by dividing and replanting the stools. Seeds sown in the autumn, at a depth of 1 or 2 cm. and on well-prepared soil, germinate in a few days. For the first 3 or 4 months, the seedlings are weakly, and easily suffocated by weeds, unless frequently hoed. Laying down a field of this grass is therefore an expensive undertaking and still more costly if recourse is had to propagation by tufts (replanting).

Under very favourable conditions (110 mm. of rain from Aug. 29 to Sept. 1), it has been possible to obtain a first cutting at Tucumán, 6 months after sowing or replanting. As a rule the first cutting is taken 8 months after sowing or replanting, and these operations are generally performed in March or April.

Ph. bulbosa begins to flower at Tucumán at the beginning or middle of November, and the seeds ripen at the beginning or middle of December

The plant has shown great powers of resistance to cold at the Station having borne temperatures ranging from —6° C to —8° C. without any visible effects upon its young leaves. It also enjoys complete immunity from all forms of diseases

1216 - ***Andropogon purpureo-sericeus*, and Its Importance in the Improvement of Grazing Areas in the Bombay Deccan, India.** - KULKARNI, L. B., in *The Agricultural Journal of India*, Vol. XVI, pp. 388-395, pl. 1. Calcutta, July, 1921.

After reference to foregoing trials made with the wild indigenous fodder grass, *Andropogon purpureo-sericeus* 1912-15, the author proceeds to describe in detail the experiments carried out on three plots in the Government House compounds at Ganeshkind, near Poona, 1916-18. The seed was sown indiscriminately with those of other species and comparisons were duly made, and the following facts noted.

1) *A. purpureo-sericeus* grows well on all types of soil and is therefore suitable for poor land; it grows tall and quickly and yields alone up to 5000 lb. green grass per acre; hence its usefulness for silage.

2) It suppresses *A. contortus* which hitherto has been the dominant crop on the vast area of poor land of the Bombay Deccan. It was reported that *A. purpureo-sericeus* even in its dry stage was eaten by dairy

cows and maintained the milk yield in the absence of *A. Sorghum* stalks in May, while *A. contortus* was not touched by them, a fact which proves the superiority of this species as a fodder over *A. contortus*.

3) It resists drought conditions to a great extent.

This fact was further tested by actually counting the number of seedlings from a measure of 3 × 3 ft., in the experimental area affected by drought and by re-counting those that survived. The proportion was upwards of 84 %.

In 1919, 4 oz. of seeds of each of the following species were mixed together and sown broadcast in the beginning of June in a small plot of poor soil. The following shows the composition of the different grasses in weight and the height to which they grew.

Annuals	Weight	Height
	lb.	ft.
A. purpureo-sericeus	13	6
Anthesteria ciliata	4	5
Apluda varia	2	4
Ischaemum sulcatum	1	2
Thelepogon elegans	1	1

This grass acts evidently as a nurse crop to perennial grasses which are generally slow to establish, since it entirely disappeared from the plots when the latter were more dominant. It is a pioneer grass in the artificial reseeding of grazing areas.

1217 – **Napier Grass (*Pennisetum purpureum*): Promising New Forage Plant for the Philippines** (1). — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. XIII, No. 4. pp. 353-354, pl. 1. Manila, 1920.

Napier grass (*Pennisetum purpureum*) has proved greatly superior to all other forage plants now grown in the Archipelago, and in Cuba the yield reported amounts to over 550 tons of green forage per hectare per year. The author introduced this plant into the Philippines in 1918 from Honolulu and it has shown itself well adapted to the climate and soil and to be more drought resistant than any other forage plant as yet introduced into the Islands.

The food value of this grass as compared with green maize fodder is shown in the following analysis:

	Water	Protein	Carbo-hydrates	Fat	Fibre	Ash
	%	%	%	%	%	%
Napier grass .	61.81	2.92	17.29	0.29	14.77	2.92
Green maize .	79.0	1.7	12.0	0.5	5.6	1.2

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(1) For articles on other *Pennisetum* vars. see *R.* April 1919, No. 459, and *R.* July-Aug. 1920, No. 747. (*Ed.*)

The grass is well relished by horses, cattle, etc.; in order to avoid waste in feeding because of its coarse growth the author considers it unwise to allow the plant to grow more than 80 to 100 cm. high between each cutting as otherwise the lower woody ends of the grass will be rejected by the animals.

Depending upon the quality of the soil and the distribution of the rainfall, six to nine cuttings of green fodder can be made during the year after the plants are established.

Seeds have been found difficult to germinate but cuttings grow as readily as sugar cane points and should be treated very similarly The author has found that cuttings from 15 to 20 cm. long (each cutting with one or two joints, and in cases where the internodes are long, the cutting of the canes so that the topmost joint is not more than 5 cm. below the top end of the cutting), have given the best results. Where material is abundant whole canes may be laid flat in a shallow furrow and covered with soil, but where material is scarce it is advised to plant and then push diagonally into the soil so that the top ends are about even with the surface of the land.

" Merker grass, " another variety of *P. purpureum* less coarse than Napier grass has recently been tested by the Bureau of Plant Industry, United States Department of Agriculture, and also introduced into the Philippines where it is very successful as a forage plant.

1218 – **A Good Forage Plant Suitable for Cultivation at San Salvador: "Zacate jaraguá" (*Cymbopogon rufus*).** — Renson, C., in *Revista de Agricultura Tropical, Organo de la Dirección general de Agricultura e Industrias de la República de El Salvador*, Vol I, No. 1, pp. 2-9, figs. 4. San Salvador, Jan. 1921.

The author advises the cultivation in San Salvador and in Central America generally of *Cymbopogon rufus*, a forage plant native to Brazil. He describes its botanical and cultural characters, and the methods of propagation, which consist in sowing the seed in pockets, or dividing and planting tufts or portions of tufts. He mentions that an agriculturist, of Jauyná (San Salvador), has taken great trouble to grow *Cym. rufus* for hay (to be cut in September) or for grass. It forms good pasture until the flowering season, after which it becomes too tough. Grazing should only begin the 2nd year after sowing or planting, for by that time the plant has taken full possession of the ground, after suppressing the rest of the vegetation.

The value of *Cym. rufus* lies its being unexacting as regards soil, and resistant to drought, frost, fires, and the trampling of animals.

1219 – ***Trifolium squarrosum*, a species of Clover Behaving Like Bersim and Capable of Replacing the Latter in Some Cases.** — Fiori, A. (R. Istituto Superiore forestale di Firenze), in *L'Agricoltura coloniale*, Vol. XV, No. 8, pp. 413-416. 1 Table separate from Text. Florence, August 1, 1921.

In 1918, the author collected, in the forest of Gallipoli-Cognato, (Basilicata), a small quantity of the seeds of a clover which he subsequently classified as *Trifolium squarrosum* L. It grew so well, and its vegetative development was so luxuriant when sown next spring in the experiment field of the Cascine Forestry Institute at Florence, that he considered it desirable to continue the experiment in order to fix its biological characteristics, with a view to its possible use as a forage plant. The author has noted, so far, that:

This clover is an annual, and very nearly related to bersim (*Trifolium alexandrinum* L.). Its normal growth cycle lasts from autumn to spring, although, if sown in spring, it suceeds in flowering and ripening its seed before the summer heat sets in.

The entire plant is covered with hairs, and on fertile soil attains a height of 50-60 cm. The small leaves are oblong, and measure 5 cm. or more in length. The free portion of the stipules is linear-pointed, The capitulum, at first spherical, later becomes oblong-oval. The calyx has stiff hairs, the base is inflated, forming a bulb; there are 5 triangular lanceolate teeth, of which the lowest is the widest and longest, and is directed downwards, while the others open out forming a star, especially in the fruit. The tubular part of the calyx has 10 veins, and is slightly inflated at the bottom, and its throat is closed in the fruit, by a callosity just leaving a linear fissure in the middle; the teeth of the calyx eventually become rigid and sharp The seeds are relatively large (1 mm. to 1.5 mm. × 1.5 mm.), oval, reddish-yellow and glossy; 1000 seeds weigh 5.110 gm., or about 196 000 seeds to the kg. They are thus heavier than the seeds of bersim (Alexandrian clover), of which about 395 000 go to the kg.

Trifolium squarrosum prefers an alluvial soil and especially one that is sandy and damp; it can also stand a certain amount of salt, as it grows wild near the sea. The seeds germinate in the autumn, as soon as the first rain falls, and if the winter is mild, the plants continue growing, so that very soon in the spring, they provide an excellent crop of forage. No attempt has so far been made to mow *Trif. squarrosum* to see whether like bersim, it will shoot again from the roots.

The crop obtained represented 210 quintals of fresh grass and 66 quintals of hay per hectare.

Trifolium squarrosum is a purely Mediterranean species, its area of distribution extends towards the east as far as the Crimea and the Caspian Sea, and westwards to the Canary Islands. In Italy it grows in the centre (Tuscany), the South, in the Isles, and in Istria; it has also been reported from Liguria and the Valley of the Po, where it is of occasional occurrence only.

This clover therefore is much more widely distributed than *T. Alexannum* (a native of Asia Minor), and hence would appear to be more adaptable than the latter to different climatic and soil conditions. In order to establish this fact, a series of experiments are necessary. *T. squarrosum* has however withstood very cold winters and hard white frosts in the Cascine Gardens at Florence without visible sign of injury.

The chief practical advantages to be gained by growing this clover for forage lie in its power of profiting by the autumn, winter and spring,

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rains of the dry Mediterranean zone, where the winters are mild. The author considers *T. squarrosum* is much to be recommended as a forage plant for Central and South Italy, the Isles and especially for Libya.

As regards methods of cultivation, the information given by Dr. CARRANTE in his monograph on the Alexandrian clover (1) will prove most useful.

1220 - **The Future of Cotton Growing in Brazil, Especially in the State of Sao Paulo** (2). — I. COELHO DE SOUZA W. W.; II. PEARSE A., in *Brasil Agricola*, Vol. VI, No. 11, pp. 45-58, figs. 4. Rio de Janeiro, August 1921.

A lecture given at São Paulo, at the request of the " Sociedade rural brasileira " by Arno PEARSE (representing the United States on an International Cotton Mission in Brazil), and preceded by a lecture given by Dr. William Wilson COELHO DE SOUZA, Chief of the Cotton Service at the Ministry of Agriculture of Brazil.

I. — It cannot be denied that coffee is the chief agricultural source of wealth of Brazil, and especially of the State of São Paulo, where it is principally grown. Cotton, however, is also a very important crop, and has a brilliant future before it. In fact it is easy to foresee, that when once the present crisis is past, and the cotton factories of all countries have resumed their normal work, the amount now produced will not nearly satisfy the demand. As a rapid and largely increased production on the part of the chief producing countries cannot be expected, Brazil, which possesses soils and a climate eminently suited to the cultivation of cotton, is in an excellent position to secure a new source of revenue. By means of methodical and systematic organisation this country could become in 4 or 5 years time one of the largest sources of supply of cotton.

The State of São Paulo is especially suited to cotton-growing and produces large crops. Some of the cotton plants have lint 30 mm. long, and if selected and bred, might supply the local cotton industry which would obviate the necessity for importing the raw material from North Brazil, save the expense of carriage from Recife and allow the cotton produced in the Northern States to be exported to Europe.

The Federal Decree No. 14 177 of March 27, 1920, instituted the " Serviço do Algodão » (Cotton Service) at the Brazilian Ministry of Agriculture.

The programme of this Service, to which is entrusted the organisation of Brazilian cotton production, includes the creation of establishments for seed-growing in order to insure improvement and uniformity in type, and the adoption of prophylactic measures against diseases and parasites. This organisation will be completed by a system of practical education in cotton-growing to be given by peripatetic instructors and including information respecting: the choice of seed; careful ginning in order to remove all impurities from the lint; control methods against Pink bollworm, or " lagarta rosea " (*Pectinosphora gossypiella*), and other parasites of the cotton plant, etc. In addition, the Cotton Service advocates the provision in cotton centres of: depôts of insecticides, such as Paris green, and of simple machines for cotton cultivation (to be furnished to growers at cost price), the institution of schools of practical instruction in the use of the machines; the passing of a law making compulsory the commercial grading of cottons, the reduction (by way of encouragement) of the export dues on clean, pressed cottons classified according to commercial types, and the establishment of sanitary regulations in the interest of the cotton-worker.

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(1) A. CARRANTE, *Il Trifolio alessandrino.* Biblioteca agraria coloniale, Florence, 1916. (*Author's note.*)

(2) As regards the possible development of cotton-growing in Brazil, the report presented to the Ministry of Foreign Affairs of Brazil by Dr. Deoclecio DE CAMPOS, the Commercial attaché at the Brazilian Embassy in Rome, and Delegate of Brazil at the International Institute of Agriculture is worth studying (*Boletim do Ministerio das Relações Exteriores No.* 16, Rio de Janeiro, October 1920. (*Ed.*)

On the occasion of his tour of inspection in the district of Sorocabana (State of São Paulo), the author began to carry out the last part of this programme. He made arrangements with some of the municipalities for installing plant for the sterilisation of cotton seed by the action of heat, and for the promulgation of decrees dealing with the protection of the cotton crops against parasites and other enemies.

II. — The tour of inspection made by PEARSE through the many cotton plantations and factories of São Paulo convinced him that cotton growing might become a most successful industry in Brazil, and especially in the State he visited.

Whereas the average yield of ginned cotton per hectare is 210 kg. in United States, 110 kg. in India, 280 kg. in Egypt (where it has undergone a perceptible diminution in recent years) it is as much as 400 kg. in the State of São Paulo, and the maximum can even reach the surprising figure of 3200 kg. Further while in other countries irrigation and fertilisers are required though Egypt has the great advantage of the fertile mud deposited by the waters of the Nile, the cotton plant in São Paulo is neither irrigated nor fertilised and requires no special attention.

Some cotton plants can give staple equal to No. 36. The soil, climate, distribution of the rainfall, railway-lines and excellent harbours all contribute to render São Paulo an ideal country for the cultivation of cotton, and if it were well organised few countries could compete with it.

The area of land suitable for cotton growing in Brazil exceeds that now under the crop in the United States.

Before the War the number of jennies working in the cotton factories of the world was 140 millions; towards the middle of 1921, 60 million were standing idle. On the re-establishment of normal conditions and when all factories are in full work, demand will be greater than supply.

At the present moment, the cotton-growing industry is going through a crisis in the State of São Paulo, owing to the shortage of labour and the attacks of parasites. The first is merely a passing trouble, since there are in Europe over 20 million persons anxious to emigrate to America, and it is only necessary to attract and organise these emigrants; the second, if systematic control measures are adopted, should not prevent the production of very remunerative crops (though some losses are inevitable), as has been already proved by the example of the United States.

For cotton-growing to take its rightful place in São Paulo, it is necessary that the industry should be organised by: 1) founding Stations for the production and distribution of selected, pure healthy seed (for the cotton-plant easily becomes degenerate through natural cross-fertilisation) — 2) making demonstration plots for growing cotton and using suitable machinery for cultivating the crop; — 3) establishing experiment fields for acclimatising and testing new varieties; — 4) organising a systematic control of the parasites of the cotton plant, among which one of the most destructive in the State of São Paulo is the "curuquèrę" (*Alabama argillacea*), whose attacks can be avoided by the growth of early varieties — 5) care in gathering the crop, in order to prevent what now occurs frequently, a number of open capsules shewing fine, white lint, with the result that the warehouses are filled with bales of dirty cotton containing many impurities — 6) the institution of official regional markets in each cotton-growing municipality: such markets would insure the grading of the cotton offered for sale, and could undertake the distribution of seed (such a system has given excellent results in India and Egypt) — 7) the organisation of annual exhibitions with prizes for the best cotton shown.

Finally Pearse advises: 1) that cotton should not be picked wet, or left too long in the sun, as this spoils it; it should never be exposed for more than 3 days, dating from the opening of the boll; 2) the regular inspection of the work of the ginners, who often ruin the cotton and mix the seeds.

The introduction of the cotton plant into a systematic rotation scheme would greatly contribute to an increase in its yield, as well as in that of the crops grown in alternation with it.

1221 - **Cambodia Cotton (*Gossypium Hirsutum*): Its Deterioration and Improvement in India** (1). — Hilson, G. R. (Cotton Specialist, Madras), in *The Agricultural Journal of India*, Vol. XVI, Pt. III, pp. 235-243, pl. 1. Calcutta, May 1921.

Cambodia cotton was first brought to the notice of cultivators in the Madras Presidency in 1907 and since then its cultivation spread rapidly and the Indian Cotton Committee state in their report in 1919 that the area under this crop in the Presidency alone, was estimated at 200 000 acres.

The author traces the deterioration in quality of the lint during recent years and attributes it to the following causes:— 1) weakness and staining; bollworm, 2) shortness of staple; the first seed distributed was unselected and a mixture of types. This is followed by a description of two main lines along which crop improvement work usually proceeds which should be regarded as necessary to restore the quality of lint, etc., namely, plant selection and isolation of types and hybridisation.

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(1) See *R.* Dec. 1918, No. 1355; *R.* Jan. 1919, No. 46; *R.* May 1919, No. 595, and *R.* Sept. 1920, No. 868. (*Ed.*)

An outline is given of the usual methods recommended for use in order to obtain satisfactory results.

The two main pests from which Cambodia cotton suffers at present are stem-weevil (*Anthonomus grandis*) and bollworm (*Heliothis armiger*) the latter is the most destructive. The two control methods recommended are: 1) growing a type of plant wholly or partially immune from attack; 2) uprooting the whole crop as early as possible each year, and leaving as long an interval as possible before sowing the next crop. This is likely to prove successful in the case of stem weevil, but a starvation method appears to be the best way of dealing with bollworm. At present the interval between the up-rooting of one crop and the sowing of the next is generally not more than 2 months. If however a type could be found which would give a full yield in the first picking and as much then as is now obtained from two pickings, there would be very little point in keeping the crop standing after the beginning of June. (The present disadvantageous system consists in cropping in the beginning of May and also in mid June; the second crop has always been inferior and badly infested with bollworm).

As regards the production of a heavier yielding type, two characters are here discussed; viz. seed weight and weight of lint per seed. BALLS working with Egyptian, and HARLAND with Sea Island cotton found a positive correlation between these two characters and it is here demonstrated that a similar correlation holds good with Cambodian cotton :—. As the weight of seed increases, the weight of lint per seed also increases. The maximum weight of fibre per seed appears to be about $^3/_4$ the weight of the seed. The ginning percentage for any given weight of seed with the maximum weight of fibre is therefore practically the same all through *i. e.* about 43 %.

1222 - **Fruits of *Heeria paniculosa* in South Africa as a Source of Oil.** — *Bulletin of the Imperial Institute*, Vol. XIX. No. 1, pp. 24-25. London, 1921.

Results of investigations conducted at the Imperial Institute, London, demonstrate that the fruit of *Heeria paniculosa*, a shrub fairly plentiful in Zululand where it is known as "isifuku", contains a yield of volatile oil amounting to 5.5 % of the weight of the entire fruits. The oil obtained was mobile and colourless and had no pronounced or characteristic odour and consisted principally of terpenes. The lack of distinctive odour is however a disadvantage from the commercial standpoint.

The crushed fruits, after the removal of the volatile oil by distillation, furnished a quantity of fixed oil from the kernels equivalent to a yield of about 30 %, from the entire fruits. The oil in this case was viscous, clear and dark brown and had an aromatic and not unpleasant odour.

The fruits are not readily separable into pericarps and seed or kernel, and it would be necessary to submit the fruit to steam distillation in order to obtain the fixed oil from the residue by expression or by extraction with solvents. Fixed oil extracted from the entire fruits would inevitably be contaminated with volatile oil and consequently would be of little or no technical value. As already indicated, however, the volatile oil is not likely to be a commercial success and the above treatment would probably not be remunerative.

1223 - **Tobacco-Growing in Belgium.** — BRICOUT, D., in *Journal de la Société Nationale des Agriculteurs de Belgique*, Year 3, No. 34, pp. 295-296. Brussels, August 20, 1921.

The tobacco grown in Belgium includes a large number of varieties and its cultivation is essentially a home-industry. In some parts (at Appelterre, and in Flanders generally), tobacco has been grown for 2 centuries. The Appelterre product is famous for its mildness, aroma and good burning properties. The yield however is small: very good crop, 1 kg. of dried leaves per 20 plants; average crop, 1 kg. per 25 plants; poor crop, 1 kg. per 30 plants.

For this reason, during the War, coarse tobaccos with heavy yield were introduced into West Flanders, which became intercrossed slightly with the old varieties. The author draws attention to the danger of this hybridisation, and urges the necessity of restoring the good pre-War type, which has in fact been done already by many planters.

1224 - **Note on Pine-Apple Growing in Mexico.** — BALME, J., in *La Revista Agricola*, Vol. VI, No. 3, pp. 147-151. 5 figs., San Jacinto, Mexico, July 1921.

The pine-apple (*Ananassa sativa*), which requires a hot, damp climate, is cultivated throughout the region of the Gulf of Mexico up to an altitude of 500-800 m. The most favourable zone extends from Minatillán (Vera Cruz) to Tampico (Talmaulipas). It grows wild in many places in the State of Vera Cruz. The author is of opinion, that the strip of land bordering the road from Cordoba to Santa Lucrecia is very well-adapted for pine-apple plantations, on account of its transport facilities with the interior and the sea-ports, and the possibility of obtaining a plentiful supply of cheap labour. In this district really valuable varieties of pine-apples are to be found, the fruit is sometimes of a surprising size and may even attain a weight of 8 kg.

In the State of Vera Cruz, pine-apples require no irrigation, on account of the abundant rainfall (about 2 m. per annum), and the dews which are very well distributed.

The most favourable soils are humiferous and light, or else sandy alluvial readily permeable by water; plantations with a southern exposure produce the finest crop. Pine-apples are planted in different ways as the object may be either to obtain large fruits for local consumption, or medium-sized products for preserving. In the first case, the suckers are planted in single rows, 2 m. apart, or in double rows 60 cm. apart, 2 m. being left between each pair. The distance between the suckers varies from 60 to 90 cm., according to the variety; thus there are 5000 to 10 000 plants per hectare. In the second case, groups of 5 rows, 60 to 80 cm. apart, are made, a space of 1.20 to 2 m. being allowed between each group.

As a rule, the crop is hoed 6 to 8 times a year and in the less thickly planted fields, this can be done by hand. The workers have to adopt adequate measures for protecting their legs and hands in order to move about between the closely growing rows if the prickly varieties are cultivated.

The first flowering period begins, according to variety, 8 to 15 months after planting; 3 or 4 months later, the fruit is ripe. After cutting, the suckers appear around the stems of the parent plants, whence they are carefully removed as soon as they attain the height of 15 to 20 cm., and are then stored until the time of planting, which is 15 to 20 days before the beginning of the rainy season.

The varieties of pine-apple grown are very numerous, but in the State of Vera Cruz, Golden Queen, Porto Rico, Smooth Cayenna and Sugar Loaf only are known. The best results have been obtained with the spineless Cayenna variety. According to the author, Mexican pine-apples are superior in sweetness aroma, size and absence of fibre, to all others, the Hawaïan product, of which the number grown is very small, alone excepted.

The crop varies from 20 to 80 tons per hectare; the price of fruit sold on the field may be estimated at 60 dollars per ton for pine-apples in bulk and at 100-150 dollars per ton of selected fruit.

The " Sección de Horticultura " of the " Dirección general de Agricultura " of the United States of Mexico will furnish, on request, the fullest details regarding pine-apple growing.

1225 - The Curuba, *Tacsonia mollissima*, Edible Fruit in the Colombian Andes. — POPENOE, W., in *The Colombian Review*, Vol. I, No. 9, pp. 204-205, pl. 2 New York, Aug. 1921.

Among numerous fruits which are grown in the northern Colombian Andes, and are little known in other regions, the " curuba " (*Tacsonia mollissima*) is one of the most interesting. In Bogotá the fruit has a great reputation for edible purposes and for the preparation of refreshing drinks.

Apparently this fruit is not properly appreciated in other countries where it has been planted (southern France, southern California, Algeria) owing to a lack of knowledge as to the mode of preparation for consumption a secret which seems to be confined to the inhabitants of the Andean region. Although the plants are sub-tropical in their requirements and cannot withstand severe winters, they are sufficiently hardy for cultivation in California, Florida, along the Mediterranean coast of southern Europe, in northern India, southern Japan, South Africa and in many other parts of South America where it is up till now not grown. The author recommends the introduction of this fruit into the above mentioned countries and adds that the culture is simple and the yield usually heavy, and in addition to its value as a fruit, the curuba is an ornamental plant of a most attractive nature (genus Passiflorae).

The fruit is oblong, 3 to 4 inches in length, cream coloured or pale green externally; within its easily broken leathery skin, are numerous small black seeds, each surrounded by translucent, orange coloured juicy pulp; the flavour is somewhat acid.

1226 - **The Giant Blackberry of Colombia.** — POPENOE, W., in *The Colombian Review*, No. 8, pp. 179-181, fig. 1. New York, July 1921

The giant blackberry of Colombia with very large fruits 1 to 2 ½ in. in length and ¾ to 1 in. in breadth was noticed by Dr. F. M. CHAPMAN of the American Museum of Natural History, when travelling in Colombia several years ago.

In its native country (4° N. lat.) this plant grows at elevations 10 000 ft. above sea level, and it seems reasonable to expect that it would be a success in southern Europe and the southern United States. The author states that it is most abundant in the region of Cundinamarca where the largest fruits are produced. Its habitat, which appears to be fairly limited, is characterised by a cool and moist climate during the greater part of the year.

The fruits, almost heart shaped, are light crimson in colour, tending to become wine coloured when over ripe. They are firm in texture, of a pleasant subacid flavour when ripe, and quite acid when still green. The ripening season is said to extend through practically the whole year, but the greater number of fruits ripen from October to December. The moister soils produce the largest fruits and the poorer, more arid land the smallest fruits.

The fruits are sold in the Bogotá market and are eaten fresh or stewed.

Attention is drawn to the possibilities of improving this species by cultivation and especially by proper pruning, an important operation with all fruits of the *Rubus* family. Doubtless also this plant lends itself readily to selection and plant breeding.

It seems that this new fruit has chances of success particularly on the sandy loams of the Gulf States, Pacific Coast region (U. S.), in southern Europe, in northern India, in southern Japan and in South Africa.

1227 - **Descriptive List of Mango Varieties in India.** — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. XIII, No. 4, pp. 265-352, figs. 71. Manila, 1920.

There are numerous mango varieties in India that are of a very superior quality and could advantageously be imported into other countries, but there are also a large number of sorts that are of very little if any value to fruit growers from the commercial point of view. To aid in discrimination between the different varieties, this descriptive list has been drawn up with the aid of a series of notes sent to the author by A. C. HARTLESS, Superintendent of the Government Botanical Gardens, Saharanpur, United Provinces, accompanied by a large series of line drawings most of which are reproduced. Other descriptions, based upon fruits grown in Florida are republished from a preceding Bulletin (*Bureau of Agriculture Bulletin* No. 18, 1911, Government of Philippine Islands, Department of Agriculture and Natural Resources) and a very large number of descriptions have been adapted from "*A treatise on Mango*" by P. C. DE, "*Gardening in India*" by WOODROW (Edition 3), "*Dictionary of Economic products in India,*" by WATTS and "*The Mango in Porto Rico*" by F. C. KINMAN.

Because of the localisation of many of the Indian mango varieties, the name of the locality from which a variety is described has been given for the convenience of prospective importers. For full details of each variety it is necessary to refer readers to the original article. Lists are limited here to varieties either useful or of no value commercially. (*Asterisks denote special quality varieties*).

I. — USEFUL VARIETIES AND WORTH IMPORTATION. — Alfonso (most celebrated and commonly grown mango in the Bombay region), Amini, Amirgola, Benazir, Bombay (Calcutta Garden), Bombay (Dr. KING), Bombay Green, Bombay Yellow (two varieties recommended for high elevations), * Cambodiana, Chakla, Dadh mungo, Dhurgo-bhog, * Fajri Long, Faqirwala, Fernandez (similar to Alfonso but later fruiting), * Gopalbogh, Haden, * Hathijuhl, * Jaffna, Kachamitha, Karelia, Kishenbhog, * Kohitur (premier mango in Mushodabad), Kumrajah, Kurpura-dagi, * Lamba Bhadra, * Langra, Langra Benarsi, Langra Hardoi, Miskirund, Mohun Thakur, Pairi (Paheri, Pirie, Peary, recommended for home consumption but not for long distance shipment), Pansera, * Sandersha, Sharbati Black, Sha-pusund, * Singa puri (Singapore), Singra, Souria (Souria budaya, * Durbhanga budaya), Stalkait, * Sufaida No. 1, Sufaida No. 2, Surkha.

MEDIUM QUALITY BUT WORTH IMPORTATION. — Amiri (too acid for a good dessert fruit but might prove acceptable for preserves), Bennett, Bulbulchasm, Fajri Round, Faizan, Fasli, Gola, Gordon, Kachmahua Seedling, Kakria Stud, Karenia, Khaparia, Kistapal, Mombosa, Mullgoa, Mulgoba (for private collection only), Salibunda, Sunahra, Zarda.

INFERIOR QUALITY NOT RECOMMENDED FOR IMPORTATION AND OF NO VALUE FOR GENERAL PLANTING. — Ajwanea, Arbuthnot, Baramasi (of little value except to the plant breeder), Batasa, Belua, Bhaduria, Bhaisht, Bhurdas, Brindabani, Charkichampa (no pomological merit), Chickna, Davys (Davy's Favorite), Divine, Gajria, Kachmahua, Kala, Khajya, Krishnabogh, Kutna, Langra Large, Langra Stud, Madras, Martinique, Najibabadi, Nayab, Nucka, Payasi, Père Louis, Peters, Punia, Romani, Rupee, Sanduria, Sans Pareille, Sharbati Brown, Strawberry, Sufaida Malihabad, Sundershah, Tamancha, .

OTHER VARIETIES INCLUDED IN THE LISTS AND OPEN TO TRIAL. — Amergola, Amrita-bhog, Amrita-pal. Amrita-monda, Anarua, Antochat, Aswina, Atai, Bherwa (Chapra), Bhupali, Bijnour Safeda, Bira, Bonkhaja, Borsha, Budaga (Bhadai), Champa-daghi, Chandani (Sundali), Chini sukker, Chonga, Choursa, Chutra, Darika, Darma, Daudbogh, Dayal Singh, Derrima (Durma), Dhumo, Dilsaj, Doanti, Dudia, Dula, Durga-bhog, Durgilal, Enuria, Fernandez, Fuzli (Fuzlee Bewa), Ganeshbhog, Golabbash, Gopal-dhoba, Gopinath-bhog, Gulsukri, Guria, Himsager, Hsapeti, Ithada, Jalibandha, Kala-Alphonse, Kalachand-bhog, Kalapahar, Kalua, Kanchan-Kasha, Kancha-Mitia, Karbuza, Karpuria (Maharaj Pasand), Kartika (Kartika Jaffer Shah), Kathambi (Kathambi Sobhan Ali Khan), Katki, Kerowa, Khari (Khari Budaya), Kharmuza, Khoont (Banchore), Knapaharia, Kumukt, Ladua (Maharaji-ladua), Laldarma, Laljan-banka, Larua, Latkampi, Lerrua, Madhua, Madkupia, Maharaj-pasand, Mahbub, Mahudinagar, Majgaon, Malabar Bombay, Mejidi, Mithua, Misribhog, Miscrikund, Mohun-bhog, Mohun Thakur, Munshiwala, Nakua-laghi, Nazim-pasand, Nazirbhog, Nazuk-badan, Nim, Nowaroa, Nur-Fuzli, Nusingbhog, Ogee, Paddojola, Pakria, Patel (Cowasjee patel), Phaykalbayan, Phulia, Pirgachia, Polla, Putu, Raj-Bhog, Raja-pasand, Rarhi, Rungbahar, Sabza, Safeda, Sarat-bhog, Sarda, Sarvati, Sauna, Seha, Shahpasand, Seohind (Gopal Larooa), Shridahan, Sinduria, Sokhta, Subja, Sukul, Tars, Tehfaringa, Terha Kellua, Tisiphool, Tota, Tota pari.

Since the foregoing article was written the author has completed these lists by additional descriptions of mangos in accordance with "*The Mango in Southern California*" by F. W. POPENOE.

The experience in Florida, Hawaii, and Porto Rico with a large number of the imported grafted Indian varieties has led to disappointing results, hence the evident importance of discrimination.

1228 - **Varieties of Date Palm in the Oasis of Derna, Cyrenaica.** — BROGLIO, E. (Nursery-Gardener of the Royal Agricultural Bureau of Derna), in *L'Agricoltura Coloniale*, Vol. XV, No. 8, pp. 401-406, 14 figs. and 2 Tables separate from the text. Florence, August 1921.

The Oasis of Derna, of which the chief crops are citrus-fruits and dates, possesses some 8200 palms yielding annually from 4500 to 5000 quintals of dates. The author mentions 22 varieties, and describes 14 under their native names: 1) brelsi — 2) meccani (i. e. from Mecca) — 3) becrèri — 4) hâmra (red) — 5) abita — 6) carcàbi — 7) lemsi — 8) bella Phya — 9) tabuni — 10) hàdduri) — 11) sicàba ârus (bride's finger) — 12) elgi — 13) nuà hàmmuri — 14) nuà asfar.

The first is the most prized and most commonly grown variety; the bunches of dates weigh 25 to 35 kg. and in a good season, a tree will produce as many as 10 to 14: the fruits of the 2nd, 5th, and 6th varieties are extremely sweet; a kind of paste is made from the meccani variety. Nos. 3, 13 and 14 are valued for the laghbi (palm-tree wine) extracted from them (1). The 4th variety is used, together with its fruits in the preparation of compressed loaves for winter consumption. The fruit of the 6th variety is good for transport while the 8th is very resistant to winds.

1229 - **Yield, Preservation and Utilisation of Stones of Table Fruits Regarded as Waste Products.** — See No. 1275 of this *Review*.

1230 - **Vine-Growing and Wine-Making in Peru.** - MOLINARI, P. (Oenological Expert, Delegate of Peru, at the International Institute of Agriculture, Rome), in *I. I. I., Rassegna settimanale illustrata della produzione italiana e dei traffici del Mediterraneo e dell'Oriente*, Vol. V, General series, No. 33, Section D. Agriculture No. 8, pp. [illegible], figs 5. Milan, August 1921.

ZONE OF CULTIVATION. — From its latitude, the Republic of Peru should have the climate of the torrid zone, but on account of the cold current of the Pacific Ocean the climate of a large portion of the coast area is similar to that of Sicily.

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(1) Also called "laghmi," see *R.* June 1921, No. 672. (*Ed.*)

The vine is grown on this coast zone of which the characteristic feature is the almost absolute lack of rain.

In Peru, there are inhabited places at an altitude of 5000 m., thus differences of climate are very great and allow for the cultivation of every kind of crop. The vine grows in many localities differing much from one another in general character, some being so cold that the grapes never set, whereas in others, it is necessary to prune the vines at the vintage time, in order to insure a short period of rest. This occurs for instance, at La Merced, in Chancamayo, a damp hot, distinctly tropical zone in the interior of the country. Hence the dates of vintage, pruning and other processes vary considerably from one place to another. If however, cases of purely botanical interest when, as occurs sometimes in the case of citrus trees, buds, flowers and fruits are met with at the same time, are left out of account and the vine is regarded merely as an industrial factor, it must be recognised, that it occupies but a small place in the " Departamento " of Ica, the principal centres being Ica and Chincha.

This region is 300 km. south-east of Lima, and the vine is cultivated in a zone that almost reaches to the sea near Chincha (Tambo de Mora), and is only 80 km. distant from the coast in the vicinity of Ica. Cotton, lucerne etc., are also grown.

The vineyards of Moquegua, Locumba, Cuzco, Arequipa, Nazca and other places are of less importance. In the neighbourhood of Lima, the vine is widely grown.

It is usually not associated with other crops, but frequently " pallares " (white Lima beans), are planted between the rows, as their roots contribute a little organic matter and nitrogen to the soil. Vines are cultivated on small, average-sized and large properties.

It was mentioned above, that rain never falls in the vine zone, and it should be added that the irrigation water comes, at intervals and in small quantities, from the chain of the Andes in the summer months, that is to say from November to April. Where the supply is scantiest, as at Inca, recourse is had to irrigation by submersion. Each plot is surrounded by a kind of dyke varying in height according to the slope of the ground, which is however nearly always flat, for, with the exception of some stony slopes where the vines are allowed to creep along the soil, the vineyards are situated on the level. At whatever time the water arrives, even if it be most unseasonable, the whole vineyard is submerged once, twice or even thrice, having regard to the possibility of drought for 2 successive years. On account of the mildness of the climate, the eyes are so strongly developed that sometimes the vines bear a small second crop of grapes out of season, an anomaly usually causing small but seldom important losses.

SOIL. — The soil is as a rule alluvial, consisting chiefly (at all events as regards the upper strata) of mud transported by the irrigation water.

An examination of the soil gave the following results :

Physical Analysis:	6 to 10	per thousand	gravel.
	500 » 700	» »	coarse sand
	250 » 450	» »	fine sand.
	4.5	» »	clay.
	0.5	» »	humus
Chemical Analysis:	0.50 to 1.25	per thousand	nitrogen.
	1.80 » 2.80	» »	phosphorus.
	2.80 » 3.80	» »	potassium.

The general structure of the region is formed by the great Pacific fault which has exposed strata formerly lying at great depths, and also ancient sea-bottoms, as shewn by the remains of whales that are not infrequently found in the belt of sand dunes stretching between the river Ica and the sea (Ocucaje farm), as well as from the phosphatic nodules with which the region is thickly strewn. The analysis of these nodules has shown them to contain 10.04 % of phosphoric acid and 41.06 % tricalcic phosphate.

The vines are little fertilised. Dung is not used for manuring, and chemical fertilisers as well as guano are reserved for the great industrial crops of sugar cane in the north of Peru.

Where the vine is not fertilised, and little trouble is taken to work the soil, or adopt prophylactic measures against disease, the average amount of must obtained never exceeds 25 hectolitres per hectare.

The regions named above would be very suitable for vine-growing, as is sufficiently proved by the fact that the vineyard of Ocucaja, at the present time the largest in Peru, having 75 specialised hectares in one plot, can produce 80 hectolitres of must per hectare. This figure could be much exceeded in the new vineyards, for the vine grows well, and is little subjected to adverse conditions. The author attained this result from an old vineyard, without any replanting, after only 4-5 years of systematic treatment; thus proving the fertility of the vine-growing regions of Peru, which is far greater than has hitherto been supposed.

ADVERSE CIRCUMSTANCES. — These are much fewer than in Europe. Hail never falls; no phylloxera exist, except at Moquegua, where it has little opportunity of spreading, owing to the sandy character of the soil, and the system of irrigation by submersion. Eel-worms are found in some places only (the regions of Chincha and Lima), and can easily be controlled. Mildew and oidium rarely attack the native stocks, and would continue to be of little importance, except in the district of Lima, even if more attention were paid to the vine. Italian and French stocks are the chief sufferers from oidium, and in localities subject to sea-fogs are attacked also by moulds. All that is needed, in order to obtain a good crop of grapes, is to give the vines normal care and attention. " Rebrote, " or secondary and unseasonable vegetation, rarely does any serious injury and any bad effect could be remedied in a great measure by improving the present methods of cultivation. In these regions, snow is unknown and no true frosts occur. The minimum temperature (which is exceptional), may be fixed at +5° C. A rapid fall of the thermometer, below the daily morning and evening temperatures at the time of flowering may occasion a certain amount of injury, but such meteorological changes are of rare occurrence. Grasshoppers and wasps can also do some mischief, but in certain regions only.

It is a fact that in the district of Ica, which is the most suited to the vine, the local stocks may be said to need no special treatment, while the Italian and French varieties can be protected perfectly by two sprayings with permanganate of potassium (125 to 150 gm. per hectolitre of water). Sulphur is also applied, but is of little use, for as a rule, it comes from California, and is badly ground, and also, owing to the very slight viscosity of the leaves and the dryness of the air, it soon falls to the ground.

VITICULTURAL PRACTICE. — This continues to improve, and present defects must be attributed to the comparatively recent introduction of the vine into S. America. This is said to be due to Francisco CARAVANTES, who in the first years of the conquest transplanted some Spanish vines from the Canary Isles, which had been the first stage on their journey from Europe. The first mention of the vine in Peru dates from 1555; it was brought to the country by Capt. Barthélemy TERRACAS, and it appears, that already in 1560 a certain LOPEZ DE CASALLES began wine-making in the neighbourhood of Cuzco, a town which had shortly before been the residence of the Inca, Emperor of Peru.

The training of the vine has not been brought to perfection, the two most commonly adopted methods are the Roman "jugum" and the low tunnel with props of dead "algarrobo" (a kind of very resistant, wild carob); in some regions, little pillars of unbaked bricks are used. These supports are not economical, and wire is now being increasingly employed. In places where irrigation without submersion is impossible, the vines are also trained in vase-shape with props.

The vines are nearly always cut back to 2 or 3 eyes, this method of pruning being suitable to arid districts; too severe pruning is however injurious in the case of Italian varieties such as Barbera and some French vines as it shortens the duration of the productive period. The stocks are as a rule, very vigorous, and in 1915, the author saw vines over 20 cm. in circumference in the vicinity of Ica (Hacienda José), some of which could well stand cleft-grafting. The vintage begins at the end of February and finishes in April.

VINES CULTIVATED. — The chief and most widely grown indigenous stocks which are descended from the vines originally imported are: — 1) "Quebranta" (a word meaning "breaks"), it is certainly near akin to the Piedmontese Barolo, a variety that has now almost entirely disappeared but was formerly known in the Piedmontese dialect by the name of "sciapa duye" ("casse-bocal"). "Quebranta" is a hardy, vigorous vine, bunches and fruit well-developed; rich in must; skin slightly coloured: 2) Neyra and 3) Moscatel, also hardy and vigorous, but with smaller berries containing less must than the grapes of the preceding variety. The third, in spite of its name, has no connection with the Muscat; perhaps it is the Blue Moscatel of Spain which when ripe takes the colour of Cordovan leather.

Next come : Rosada, the same as the Italian " Somarello ", and also very widely grown in California ; Moyar, Albilla and other less important varieties. Albilla bears long bunches of small, white grapes, the fruit of Moyar is larger, but also colourless. Albilla produces an excellent dry white wine equal in value to some of the European vintages Its fruit is made into wine separately and without any admixture of other grapes.

The other grapes, when mixed, are used to make ordinary white wines, being added to the first pressure musts (forming about ¼ of the total), and also ordinary red wines, which ferment with the pomace. The socalled " special" table-vintages are made from the vines of the French group and with Barbera ; these are not, however, well identified, but chiefly serve to improve the colour, alcoholic taste and flavour of the wines manufactured from common grapes. To obtain a good colour, recourse is also had to grapes like the " tintorera " with coloured must, for even the varieties with coloured skins produce a very pale must that afterwards assumes indefinite tints in the wine, the colouring matter being easily precipitated, thus causing much anxiety to the oenologist.

The vine most grown is " Italia " (Moscatellone), a variety that from its name must have been brought from Italy at some undetermined date. Its fruit is used for the table and is dried for raisins. These grapes are also employed in the manufacture of sweet wines (" moscato piemontese " type), liqueur wines (Lipari and Syracuse type) the better class of dry white wines, and finally in making " Italia " brandy. This liqueur is absolutely unrivalled, and is greatly in request in Peru and the neighbouring Republics, where the typical drink, if it may be so termed, is " aguardiente " (brandy), and not wine.

Peruvian brandies are often known under the general name of " Pisco, " from the shipping port, or " puro de Ica, " but are sometimes called by the name of the vine, " Moscatel Italia, " etc.

UTILISATION OF THE CROP. — It should be mentioned, that on account of the hot climate and the careless habits of the natives, the Spanish conquerors distilled their wines and brandies on the spot, thus obtaining a product that was both stable and easy of transport. As they used new wine and not pomace (which was thrown away after it had been slightly pressed), in the manufacture of " aguardiente, " the latter was a very fine brandy, greatly superior to " grappa " (pomace brandy). Peruvian " aguardiente " contains 46 % of alcohol when sold.

Wine production has progressively increased during the last few decades only. No exact statistics are available, but it may be estimated that in Peru, there are not more than 7500 hectares under vines. At the present time, half the grapes (the total being 190 000 hectolitres at the rate of 25 hectolitres per hectare), are made into brandy, the other half being used for wine, or else eaten fresh or dried, some of the dried raisins being secretly used for the manufacture of wine in the large towns.

Thus the yield is less than 100 000 hectolitres which is insufficient to supply the constantly increasing demand, and also insufficient from the hygienic point of view, for it is most desirable that less spirits (especially the deleterious brandies made from imported cereals), should be consumed, and that wine, beer and " chicha " (a local incompletely prepared beer) should be substituted.

The wine making expert has not only to contend with difficulties connected with colour, which is one of his chief troubles, but also with the excessive heat, (at the time of the vintage the thermometer registers about 32° C.) and with the defective character of the must, the glucose content of which as soon as the grapes happen to be a little over-ripe, varies from 25 % to 30 %, whereas the amount of acid is very low, seldom exceeding 3.5 parts per thousand. As the temperature of the water is about 20° C., the cooling process is both difficult and costly.

The true solution of these problems consists in the use of pure yeasts and of selected ferments accustomed to strong doses of sulphite and alcohol, and in rapid fermentation etc. This would however necessitate working on a large scale, and the employment of a technique better than is at present possible except in very rare cases. Hence most of the winemakers content themselves with using receptacles having a capacity of a few hectolitres only so that the mass cools rapidly, the must is easily handled and the tunning etc. can be carried out quickly. It is certain that the ordinary products are deficient in alcohol, but an expert, having at his disposal all the appliances generally used in the best cellars of Europe, could at once obtain fairly good wines, which he could gradually improve.

The Ica wines are the most valued, the products of Chincha, being weaker and more doctored, are more suitable for general trade, although the cellars of the district are the better equipped.

The most characteristic wines are the liqueur types, such as " Lipari " and " Muscat de Syracusa " of 8 to 10°; a small portion of the alcohol is produced by the must itself at the beginning of fermentation, later more is added and the alcohol content is raised to 16-17 %. For this vintage, a 60-65 % redistilled brandy should always be used, and never rectified alcohol. The type is subsequently obtained by the addition of " arrope, " must reduced over the fire to about ¼ its volume. If these wines are left to mature for 2 years in 4-hectolitre vats, an excellent product is obtained.

The Ica district, owing to the type of grapes and especially to the large quantity of the Italia variety grown, is an ideal region for the manufacture, of these wines, which find a ready market in Peru and the neighbouring Republics.

1231 - **Re-Afforestation of the State of Rio de Janeiro, Brazil.** — SAMPAIO A. J., in *Boletim do Ministerio da Agricultura Industria e Commercio*, Vol. IX, No. III, July September, 1920, pp. 29-30. Rio de Janeiro, 1921.

A report sent by the author to the Director of the National Museum at Rio de Janeiro, giving an account of his work on the occasion of the botanical exploration of the riverine district of Rio Itabapoana, within the frontiers of Rio de Janeiro and Espirito Santo.

Many valuable types of trees mentioned by Caminhoa in his " Tratado de Botanica," once forming a source of wealth to the district, have now disappeared owing to reckless felling. Even wood for fuel has become dear, and is very scarce in certain places. The author urges strongly that this state of affairs should be remedied, and suggests the adoption of the following measures:

1) The preservation of any woods and nuclei of young tree growth still remaining on all agricultural land, together with the manuring of impoverished soil, instead of tree-felling for the purpose of obtaining fertile land;

2) the plantation of young trees in the pastures used for cattle-rearing. When the trees are grown, they will afford a grateful shade to the stock;

3) the plantation of clumps of trees on high ground and declivities;

4) the cultivation of water-loving species (eucalyptus), on low-lying, damp land, which will thus be naturally drained. If the soil is first limed, the hydrophilous, herbaceous plants will be destroyed, and the ground rendered suitable for tree growth;

5) the afforestation of the coast zone.

1232 - **The Black Walnut (Juglans nigra): Its Growth, Distribution, Management and Utilisation.** — I. BAKER, F. S. (Forest Examiner). Black Walnut: Its Growth and Management, *U. S. Department of Agriculture, Bulletin* No. 933 (Contribution from the Forest Service. Professional Paper), pp. 1-43, figs. 4, pl. 7, tables 18. Washington D. C., March 8, 1921. — II. BRUSH, W. D. (Scientific Assistant). Utilisation of Black Walnut. *Ibid. Bulletin* No. 909, pp. 1-89, tables 27, pl. 14. Washington, D. C., Jan. 17, 1921.

I. — The importance of black walnut (*Juglans nigra* Linn.) was evidenced during the war in the demands made to secure this wood for gunstocks and aeroplane propellors. The demand since then has continued to be heavy, owing to the high value of walnut for its seasoning, easy working and gluing qualities, etc. and its consequent adaptability to various uses. Great importance may therefore, be attached to the questions of available supply, growth and management of this tree, and to the financial possibilities of growing it for the timber market. It is with this in view that the author here presents such information as is available on these subjects.

DISTRIBUTION. — The botanical range is from southern New England and Ontario to Minnesota, South Dakota, and Nebraska, south into Texas and east to Georgia, and extending to the coast of South Carolina. The commercial range is wide, but the best natural development is to be found probably in the Ohio River Basin, in the southern Appalachians or in Arkansas.

The estimated stands for 28 States is given as 821 000 000 board feet (taken from the point of view of production of timber), but probably 50 % is inaccessible to manufacturers.

The author gives a detailed description of the tree, including size, form, branches, roots, bark, leaves, flowers and nuts, and outlines the sylvical characteristics concerning soil and moisture requirements, reproduction, diseases, etc.

As regards the growth of individual trees, selected measurements are given illustrating the rate of diametric and volumetric growth under specific conditions, and comparisons are made in tabular form between the rate of growth in diameter and the formation of sapwood.

As regards the growth of stands (yield per acre), taking 55.6 as the number of trees per acre, the estimated yield is 4 660 board feet. Data concerning other groves are also given.

The DOYLE rule is in general use for measuring logs and estimating standing timber. Computations were made on approximately 12 000 000 board feet of logs purchased towards the close of the War to show the average size of logs from different States. Michigan, Illinois, Iowa and Nebraska show the highest average varying from 106.63 to 79.43 board feet per log., and Maryland and Alabama showed the lowest average 55.10 and 51.88. The average for all logs from the States taken as a whole amounts to 76.38 board feet per log.

ESTABLISHMENT OF PLANTATIONS. — A comparison between artificial and natural stands has been made, the figures being based dupon measurements for 90 plantations. After the planted trees reached 50 years of age the growth was slower than that of the slowest observed in natural stands and the quality was very inferior to the clean straight tall boles of the forest grown trees. The diameter, breast high, in plantations at the age of 50 was 10.9 in. compared with 15.7 average growth in natural stands. The best criterion for determining a planting site is thus evidently the notification of areas on which the tree flourishes naturally. Nuts may be planted in the autumn 2 or 3 in. apart (2 nuts per hole) in rows 6 in. apart and the seedlings transplanted the following spring to their permanent quarters; the final spacing should be 4 × 4 feet, or where space is not limited, 6 × 16 ft. If the trees are grown for the production of nuts, a spacing of 50 to 60 ft. is considered advisable. Whenever planting is done the aim should be to provide for the maturing at one time of 40 trees at least. In a close plantation 80 % of the trees will be cut in thinnings before maturity.

II. — UTILISATION. — This bulletin deals with the characteristics, properties, uses, manufacture and market values of black walnut wood, and the uses to which it is best adapted.

The properties of black walnut wood, actual, comparative, tested green are given with diagrams and may be summarised as follows:—

Weight per cub. ft.: green. 58 lb., air-dry 39 lb., kiln dry 37 lb. *Specific gravity*, when dry, based on volume when green, 0.51. *Shrinkage from green to oven dry condition* % in volume 11.3, radial 5.2, tangential 7.1. *Strength in bending*: Modulus of rupture 9500 lb. per sq. inch., relative strength compared with oak (oak = 100), 114. *Strength in compression parallel to grain*: maximum crushing strength 4 300 lb. per sq. inch.; relative strength compared with oak (oak = 100) 121. *Strength in compression perpendicular to grain*: fibre stress at elastic limit 600 lb. per sq. inch.; Relative strength compared with oak (oak = 100) 72. *Stiffness*: Modulus of elasticity in bending, 1420 (1000 lb. per sq. inch); relative stiffness compared with oak (oak = 100) 114. *Hardness*: Load required to embed a 0.44

inch ball 1/2 its diameter, 900 lb., relative hardness compared with oak, (oak = 100) 85. *Shock resisting ability*; work to maximum load in bending, inch lb. per cub. inches 14.6; relative shock resisting ability compared with oak (oak = 100) 127. *Shearing strength parallel to grain*: shearing strength 1220 lb per sq. inch.; Relative shearing strength compared with oak (oak = 100) 98.

Walnut veneer is cut by the straight rotary, stay log rotary or straight-slice process. Manufacturers get about 20 sq. ft. of veneer from each board foot of logs, log scale, with a waste of about 55 %. This waste is unavoidable, and includes the sap-wood (the defective veneer of which is not marketable) the wood trimmed off before a sheet of saleable width is obtained, the waste due to defects, and the " dogboard. " Owing to the fact that walnut veneer logs run comparatively small in size, wide walnut veneer is much in demand.

Apart from the above mentioned uses, walnut has been found a suitable wood for railway sleepers, fences and firewood, but only small and defective material is ordinarily converted into these products. In the appendix is given a detailed list of the various uses of black walnut reported by factories, including boxes and crates, brooms and carpet sweepers, cars, caskets and coffins, chairs, clocks, firearms, fixtures, frames, handles, professional and scientific instruments machines, planing mill products, printers' materials, refrigerators, doors, sashes, etc., ships, vehicles, canes, rackets, etc. The author gives a brief survey of the adaptability of the wood to these various branches of industry, and also gives the data referring to the amounts and values of walnut logs exported from the United States 1912-17. Data are not available on the export of walnut veneer.

Although the present very high market price of the timber may not be maintained, walnut will always be in demand and will bring good prices because of the intrinsic value of the wood. Owners of timber tracts containing walnut will generally find it profitable to give preference to the young growth of this timber rather than to that of the less valuable species. Owners can dispose of their trees to best advantage to walnut lumber and veneer manufacturers and to factories that purchase walnut in the log form; figured walnut is more valuable than plain. Walnut firms do not, as a rule, publish a fixed scale of prices and log grades, the prices being usually set by the log buyer.

Tables show the amount and values of walnut logs exported from the United States during the fiscal years ending June 30, 1912 to 1917. In 1912 the value per 1000 board feet amounted to $62.35; in 1913, to $54.49 and from then onwards there has been an increase in value, amounting in 1917 to as much as $104.33. None was exported for the year 1918.

1233 - **New Zealand Waste Timber for Paper Making.** — *Bulletin of the Imperial Institute* Vol. XIX, No. 1, pp. 1-10. London, 1921.

Results of examination of eight New Zealand timbers submitted for inspection to the Imperial Institute with reference to the possibilities of utilising the waste wood produced in the manufacture of paper pulp The chemical examination and paper making trials were carried out on wood freed from bark and the results refer throughout to the air dried wood.

The species examined were as follows :—

I. — *Fagus* (*Nothofagus*) *Solandri.* — Results show that the wood gives a fairly good yield of pulp (41.5 to 42.5 %) which bleaches almost white and furnishes an opaque paper of satisfactory quality.

II. — *Fagus* (*Nothofagus*) *cliffortioides.* — A very abundant species with yield equal to that from the above mentioned sample, but the pulp is more readily bleached.

III. — *Fagus* (*Nothofagus*) *Menziesii.* — Yield equal to the two preceding species and the pulp of similar quality.

IV. — *Weinmannia racemosa.* — Yield rather low (36.5 to 40.0 %), but the pulp bleaches satisfactorily, has good felting properties and furnishes paper of fairly good strength.

V. — *Fagus* (*Nothofagus*) *fusca.* — Fairly good yield of pulp (44.0 to 47.5 % dry pulp), bleaches well and gives a paper of satisfactory quality.

VI. — *Beilschmiedia Tawa.* — Very abundant species ; fairly good yield of pulp (43.5 to 44.0 % dry pulp), and furnishes paper of good quality and fair strength.

VIII. — *Pinus Laricio.* — Wood difficult to disintegrate probably on account of the presence of knots. Yield of pulp not very high (39 to 45 %) and bleaches to a cream colour.

VIII. — *Pinus radiata.* — As in the preceding case the numerous knots in this material rendered it difficult to disintegrate and necessary to employ a high percentage of caustic soda. The pulp produced is similar to that obtained from the *P. Laricio* wood both in quantity and yield. Strong papers were obtained from both these woods.

The first six species are indigenous to New Zealand and the last two are introduced trees, now being planted on a large scale throughout the Dominion.

All these timbers would be suitable for the manufacture of paper pulp in New Zealand if available in sufficient quantities, but attention is called to the fact that before the manufacture of pulp can be undertaken on a commercial scale a number of factors will need careful consideration. Amongst these it is notified that from the results of the trials described above, the woods of the four species of *Fagus* (*Nothofagus*) and those of *Beilschmiedia Tawa* and *Weinmannia racemosa* might be used in admixture where the quantity of waste wood of one kind is limited. The woods of *Pinus Laricio* and *P. radiata*, however, should not be mixed with the others, owing to the more drastic treatment required.

LIVE STOCK AND BREEDING

1234 - **Experiments Made in the United States on the Efficacy of Carbon Tetrachloride as an Anthelminthic, Especially against Hookworm** (1). — HALL, M. C. (Bureau of Animal Industry, United States Department of Agriculture), in *The Journal of Agricultural Research*, Vol. XXI, No. 2, pp. 157-175, bibliography of 22 works. Washington, April 1921.

After reviewing the experiments hitherto carried out with regard to the use of carbon tetrachloride in medicine, the author describes his own investigations as to the relative efficacy of this substance and other drugs commonly used to remove hookworms.

Experiments on dogs showed that carbon tetrachloride in doses of 0.3 cm^3 per kg. of live weight is more effective (efficacy 100 %), than any of the other anthelminthics used.

Chloroform, in doses of 0.1 cm^3 to 0.2 cm^3 per kg. of live weight, when given in castor oil, was only 54 % effective against hookworms, while a single dose or even repeated doses of oil of chenopodium, had only an efficacy of 20 %. The best results (average efficacy 69 %), were obtained with repeated doses of oil of chenopodium followed by chloroform. The maximum efficacy (89 %), was obtained by giving 3 doses (of 0.33 to 0.65 gm.) of oil of chenopodium at 1 hour intervals, each dose being accompanied by 14.18 gm. of castor oil, and followed half an hour later, by 0.4 cm^3 of chloroform in 14.18 gm. of castor oil.

Thymol proved to have an efficacy of 15 % only. The experiments further showed that carbon tetrachloride is a very safe drug, as it was apparently quite harmless even in doses 5 times as large as was necessary to insure complete efficacy.

It is also very effective in removing Ascarids, though somewhat inferior to oil of chenopodium in this respect. Carbon tetrachloride will, like other anthelminthics, expel whipworms (*Trichuris depressiuscula*) when they get into the caecum. It is however of no value against tapeworms (cestodes).

1235 - **Intrapalpebral Reaction for the Diagnosis of Dourine** (2). — LANFRANCHI, A. and SANI, L. (Istituto di Patologia Speciale e Clinica medica veterinaria della R. Università di Bologna), in *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 7, pp. 374-378, 1 Plate. Paris, July 1921.

The technique of the intrapalpebral reaction has been tried in the diagnosis of dourine.

The authors used as an antigene some trypanosomes (*Trypanosoma brucei* and virus LANFRANCHI) in the pure state; they were freed of blood means of a haemolytic serum, and then emulsified. either with pure glycerine (1 : 3), or with glycerine in a physiological solution, or in distilled water.

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(1) See *R.* Oct. 1918, No. 1128. (*Ed.*)

(2) See *R.* May 1921, N. 519. (*Ed.*)

In the case of infected animals, the reactions are almost the same as the positive reaction to mallein. Swelling of the eyelids shows itself from the 3rd or 4th hour, and reaches its maximum between the 12th and 18th then the oedema is slowly reabsorbed, though perceptible until the 36th hour.

There is usually a slight thermic reaction, as well as more or less noticeable local symptoms (photophobia, lachrymation). After the application of the treatment, or even during its course, the local oedema was found to develop more rapidly, attaining its maximum about the 10th or 11th hour, and disappearing between the 20th and 24th. The thermic reaction was also weaker.

The local reaction is much the same in healthy as in infected animals, the thermic reaction and other general symptoms do not appear.

There is no doubt, that results of practical utility would be obtained by using *Trypanosoma equiperdum* as an antigene.

1236 – **Transmission of Rinderpest to Pigs of the Celtic Breed.** — NICHOLAS, E., and RINJARD, P., in *Comptes rendus des séances de la Société de Biologie*, Meeting of June 25, 1921, pp. 168-170. Paris, June 1921.

Experiments carried out by the authors at the Cureghem central Station for the preparation of serum, during the recent outbreak of Rinderpest in Belgium, with a view to obtaining more exact information respecting the important question, whether Celtic pigs are susceptible to the disease. Adult as well as young animals were experimented upon, being infected artificially through the mouth and by means of subcutaneous injections. The pigs reacted and became ill, some even died (occasionally after a considerable time had elapsed) from lesions similar to those induced by Rinderpest.

Scientific proof was obtained by the re-infection of 2 cows kept under conditions excluding all possibility of accidental contagion. These animals contracted the disease after an incubation period of 3 to 3 ½ days, and died in 4 days with the characteristic pest lesions.

It is thus quite certain, that pigs of the Celtic breed are susceptible to Rinderpest, though the disease in their case is far from assuming such a serious character as in cattle. It occurs sometimes in so light a form, as hardly to affect the victims, and thus passes unobserved. For this reason, pigs in Belgium have hitherto always been regarded as immune to the malady. It is most necessary therefore, in times of an outbreak of Rinderpest that all swine should be carefully watched.

1237 – **Coccidiosis of Ruminants in South Anam.** — SCHEIN, H., in *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 7, pp. 380-382. Paris, July 1921.

The goats of the district of Nhatrang are very often attacked by a coccid, probably *Eimeria arloingi*, the same species that VELU has recorded as occuring in Morocco (1).

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(1) See *R.* July-Sept. 1919, No. 927. (*Ed.*)

Nearly all the goats are infected, but as a rule the parasite causes the death of young animals only which happen to be in a weak condition owing to weaning, eating damp forage during the rainy season, the effect of intercurrent diseases, etc.

Adult animals, except after inoculation for Rinderpest, do not appear to suffer to any great extent, from *Eimeria arloingi* and harbour but few of this coccid.

The disease usually manifests itself by intestinal disturbances resulting in diarrhoea (the evacuations contain mucus which is sometimes tinged with blood), and causes anaemia and rapid cachexy, the parasites being present in large numbers.

Occasionally only, coccids about to form spores are found in the excreta. If the latter is placed in a moist chamber for some days, the proportion of segmented parasites becomes larger.

The results of post-mortem examination are given and also some notes upon the shape and dimensions of the cysts and sporoblasts. The goats of Nhatrang are reared near the sea, on sandy and very dry ground where the conditions would appear *a priori* to be unfavourable to the spread of the disease; even adult animals however brought from the dampest mountain regions often catch the malady in a severe and fatal form, although arriving at the coast in the summer. It would thus appear that exposure to infection from youth confers immunity from this intestinal parasite.

There are very few sheep in this part of the country, and those the author has hitherto been able to examine showed no signs of coccidiosis.

He found however a coccid in calves and buffaloes that was so similar to the microrganism present in the goats as to be in all probability the same. It however occurred only in cattle during Rinderpest reaction and amongst these the intestinal disturbance was especially severe. There was no sign of it in healthy individuals, but the author thinks it probable that some of the latter act as coccidiosis carriers.

SCHUTZ has already observed in India that Rinderpest appears to have the effect of aggravating the symptoms of coccidiosis. This appears most likely, and therefore in regions where coccids abound, it would be well, when combating Rinderpest, to increase the dose of the specific serum, and at the same time, to apply the remedies used in cases of coccidiosis.

1238 – **Note on Canine Rabies in the French Sudan.** — ARLO, I., in *Bulletin de la Société de Pathologie exotique*, Meeting of July 13, 1921, Vol. XIV, No. 7, pp. 368-373. Paris, July 1921.

In the course of his study of Sudanese rabies, the author has come to the conclusion, that it has not been imported into the Sudan, and does not appear transmissible to man.

The natural virus seems very easily destroyed, and not very toxic. All attempts to obtain a fixed virus for laboratory purposes proved unsuccessful.

1239 - **Note on Some Bird Parasites of the Belgian Congo.** — Ghesquière, M. I. (Entomologist of the Congo Government), in *Annales de Gembloux*, Year XXVII, No. 7, pp 239-242, Brussels, July 1921.

The author has made a study of the parasites attacking poultry in the Belgian Congo, and drawn up a list of those which he believes to cause a relatively high rate of mortality. The parasites mentioned are as follows:

In fowls: the nematode *Filaria gallinarum* — Cestoda — the Mites, *Cnemidocoptes mutans, Argas persicus, Sarcoptes laevis* (causing feather-eating), and *Dermanyssus gallinae* — the Mallophaga, *Geniottes gigas, Lipeurus meleagridis* and *Menopon staminarum* — the Siphonapteron *Sarcopsylla gallicanea.*

In turkeys: the Mite, *Amblyomma hebraeum* and the Malophagos, *Lipeurus meleagridis.*

In pigeons: the Dipteron, *Lyncha maura.*

As regards *Filaria gallinarum,* it may be said that 80 % of the fowls suffer from intestinal filariosis. The native birds seem to resist the disease better than fowls imported from Europe; severe cases are relatively rare. This parasite causes different gastro-intestinal disturbances (colic, dysenteric enteritis), which are followed by loss of flesh and by anaemia, which produce a cachectic condition terminating in death. The intermediate host of *Filaria* is *Hoolotermos pretoriensis* Ful., a fairly common species of termite.

Cestodes and nematodes are often found in association, and a *post mortem* examination has not only revealed complicated intestinal helminthiasis, but has further shown the walls of the intestines to be covered with haemorrhagic pustules. Microscopic investigation of a portion of the contents of the intestines also manifested the presence of large bacteria invading the dead tissues, and of an abnormal number of *Bacillus coli communis.*

The author in conclusion mentions a severe chronic form of diphtheria that occurred at Nyangwé and Barumbu in 1920, and at Eala, in 1921.

He proposes to give in a supplementary note, the control measures that have been successfully adopted against these parasites in the Belgian Congo.

1240 - **Research on the Bacilli of Avian Tuberculosis.** — Jousset, A., in *Annales de l'Institut Pasteur,* Vol. XXXV, No. 9, pp. 603-620. Paris, 1921.

The author, in the course of his researches on antituberculosis inoculation, and serotherapeutics, had occasion to study numerous types of bacteria. After trying many other species, he made some immunisation experiments with the bacillus of bird tuberculosis. The negative results obtained, together with the discovery of a series of hitherto unpublished, but very marked characters belonging to this type of micro-organis gradually led him to doubt the identity of the bacilli of the mammalian and avian forms of tuberculosis. He then carried out a series of test experiments, the results of which are given in the article analysed and summarised as follows:

Certain avian bacilli have a number of well-marked natural characters which entitle them to be regarded as a distinct form, and not to be identified with the bacillus described by KOCH as occurring in man and cattle.

These characters, which are of very different significance are as follows:

Absence of any uniting substance.

Invariability of reaction to the culture medium.

Longevity on artificial media as opposed to the susceptible character of the virus.

Inferior local power of producing casein.

Intense toxic action on horses.

Weak and negligible local or general effects upon a tuberculous organism caused by the tuberculin obtained from these bacilli.

Absence of all power of conferring specific immunity against the bacillus of human or bovine tuberculosis.

Of all these characters, two deserve special notice as clearly differentiating the types of bacillus studied from the bacilli present in mammals: these are the necrotic and the immunity reactions respectively, all the others being of relative importance only.

The question arises whether bacilli with such characters are of exceptional occurrence. Everything points to their being very frequently, if not invariably, present in cases of bird tuberculosis.

This view is based upon the analogy between the above mentioned characters and the properties recorded in all descriptions of the pathogenetic agent of avian tuberculosis which led VILLEMIN, and afterwards STRAUS, to entertain serious doubts as to the relationship between avian and mammalian tuberculosis. " It would however be very rash, and still more dangerous, to make this question subordinate to the merely speculative and philosophical theory of the single origin of the various forms of tuberculosis bacteria, an idea, which has but served to spread confusion, and should never have been introduced into the discussion ".

The author, considering the question simply from the practical standpoint, concludes as follows:

1) Bird tuberculosis is due to different causes amongst which occur: *a*) very exceptionally, the bacillus of mammalian tuberculosis; *b*) very frequently, acid-resistant bacilli, occasionally endowed with a certain power of inducing tuberculosis.

2) This property of producing tuberculosis, which is as regular and complete (power of causing necrosis) in the first type of bacilli, as it is irregular and incomplete in the second, in no wise justifies the identification of the two groups.

3) The two types of bacilli are sometimes clearly distinguished by their immunity reactions.

1241 – **The Distribution of Non-Proteic Nitrogen in the Organism.** — DELAUNAY, H., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXV, No. 26 (Meeting of July 16, 192[illegible]), pp. 360-362. Paris, 1921.

The author's experiments carried out on adult, or recently-born mammals of different species (dogs, cats, rabbits and guinea-pigs), both when fasting and after food in the first place confirmed the already well known fact, that considerable quantities of amino-acids are present in the blood and tissues of vertebrates. They also give further information as to the ratio between the various forms of nitrogen present and the total non-protein nitrogen. The following is a summary of the results obtained:

1) PROPORTION OF UNDETERMINED NITROGEN TO THE TOTAL NON PROTEIC NITROGEN. — The undetermined nitrogen, which includes all the nitrogen present in the different organs that has not been estimated (urea, amino acids, ammonia and polypeptids), forms in the case of the urine, from 10 to 15 % only of the total nitrogen. The proportion in the blood is higher (30 to 50 %). For the organs of any individual animal, there is a kind of average figure, usually below that for the blood. Little variation is observed in this respect between the different organs in the same individual. On the other hand, the physical condition causes the mean of the undetermined nitrogen in the organs to vary considerably, but the amount present is always large (40 to 70 %).

2) AMOUNT OF AMINO NITROGEN. — As is seen on referring to the graph given in the text, the various organs can be classified according to their amino nitrogen content. Some parts of the body (the spleen, liver and mucous lining of the intestine) take the first place, whether the animal is fasting or after feeding, and have clearly a larger amount of amino-nitrogen than others. Then come in descending order, subject however to variation, the lungs, brain, muscles, kidneys and finally, the blood.

3) AMOUNT OF AMMONIAL NITROGEN. — The percentage of this form of nitrogen is always low, and varies from 1 to 6, whereas that of amino nitrogen is between 15 and 35. The muscles and liver appear to contain slightly more ammoniacal nitrogen than the other organs.

Contrary to what might have been expected, there is no parallelism between the amount of amino nitrogen and that of ammoniacal nitrogen.

4) AMOUNT OF URIC NITROGEN. — The blood has always proved to be richer in urea than the other organs studied, though it is frequently poorer in amino nitrogen. After the blood, the kidney contains most urea. The percentage of uric nitrogen in the other organs varies around a mean which is below the figures given for the kidneys and blood.

5) AMOUNT OF NITROGEN THAT CAN BE ESTIMATED BY THE TANRET REACTION. — Very little only of this nitrogen is to be found, the amount present being below 2 % of the total non-proteic nitrogen. The spleen gives the strongest reaction and seems to be the organ containing most albuminoids and peptones. Next come the mucous linings of the intestines and the liver. The muscles give a very weak reaction. The kidneys, lungs and brain give a stronger reaction than the muscles, but one far less distinct than the digestive organs.

From these preliminary researches, it is abundantly clear that during fasting and digestion alike, the maximum amount of amino acids, albuminoids, and peptones is present in certain organs that play an important part in the digestive process (intestines, liver, spleen). The latter organs, which while digestion is in progress, have the greatest capacity of fixing the amino acids in circulation, would also appear, even during fasting, to be able to form the largest quantity. They seem thus to play an important part also in the regulation of nitrogenous metabolism.

1242 - **Physiology of Phosphorus and Calcium Metabolism of Dairy Cows** (1). — Meigs, E. B., Blatherwick, N. R., Cary, C. A., and Woodward T. E. (Research Laboratories of the Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture), in *The Journal of Biological Chemistry*, Vol. XL, No. 2, pp. 460-500. Baltimore, December 1919.

Recent work has made it seem probable that the amount of calcium and phosphorus contained in the rations of dairy cows is a matter of great practical importance. In a comprehensive series of experiments on good milking cows, Forbes and his fellow-workers (*Ohio Agricultural Experiment Station Bulletin* No. 295, 1916; No. 308, 1917; No. 330, 1918), have found that the calcium balances were always negative, and the phosphorus balances usually negative, though the rations were liberal, and in many cases contained more calcium and phosphorus than is ordinarily fed to cows yielding a large amount of milk.

When cows are fed according to their milk production, the feed — particularly the grain — is reduced with the progress of lactation, and reaches its lowest point when the cow becomes entirely dry, generally a few weeks before the next calf is born. The authors proposed to determine whether this method insures that the cows receive enough phosphorus to provide for the optimum milk yield in the next lactation period, if enough grain has been fed to provide sufficient phosphate for the maintenance of the cow and the growth of the unborn calf, as calculated from the figures given in the standard text-books.

From another series of experiments the authors have discovered that in the case of dry, pregnant cows, even if fed a much higher grain ration than usual, there is a decided tendency for the concentration of phosphorus in the blood plasm (2) to decrease towards the end of pregnancy. This tendency is more marked when the grain ration is lower. On the other hand, if the animals are given phosphates, the amount of phosphorus in the blood is increased. The authors are at present engaged in trying the effect of the addition of sodium phosphate to the ration, and intend to study the triple relationship between phosphorus in the ration, in the blood and in the urine. The results of the experiments described in the article analysed are given in 12 tables, and summarised as follows:

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(1) See *R.* July 1917, No. 648; *R.* April 1920, No. 440. (*Ed.*)

(2) See also: P. Mazzocco "Dosage du calcium du sang," in *Comptes rendus de la Société de Biologie*, Vol. LXXXV, No. 28, pp. 689-690. Paris, October 15, 1921. — P. Maz- "Le calcium sanguin chez diverses espèces", *Ibidem*, pp. 690-691. — P. Mazzocco, and R. Bustos Moron, "Le calcium sérique dans les états gravidique et puerperal", *Ibidem*, p. 692.

Prof. Mazzocco, of the Physiological Institute of the Faculty of Medicine of the University of Buenos-Ayres, states that most of the calcium is contained in the liquid portion of the blood, and is present in almost the same proportion in the serum and the plasma. The

1) The separate collection of urine and faeces by attendants, as practised in metabolism experiments on cows, produces a nervous disturbance in the animals which interferes markedly with the assimilation of calcium and to a less degree, with that of nitrogen and phosphorus. A critical examination of metabolism experiments carried out in the past indicates that, in the great majority of instances, the experimental procedure has interfered with calcium assimilation.

2) In the case of pregnant cows, the assimilation of phosphorus, and probably of calcium also, is favoured by adding bi-sodium phosphate to the grain, and by feeding the grain and hay of the ration on alternate days.

3) The urinary excretion of phosphorus is markedly influenced by the concentration of inorganic phosphorus in the blood plasma, but it is also affected by another factor, which may be connected with the acid base equilibrium of the body.

4) The authors found in their experiments, that there was an inverse relation between tne amounts of calcium and phosphorus excreted in the urine. There is however no doubt that this relation is easily disturbed by the other influences, particularly the relation between the acids and bases of the ration.

1243 - **Variations in the Fecundity of Poultry Based on Anatomical Differences in the Ovary. Experiments in the United States.** — PEARL, R., and SCHOPPE, W. J., in *The Journal of Experimental Zoology*, Vol. XXXIV, No. 1, pp. 101-108, 2 figs. 7 tables, bibliography of 9 works. Philadelphia, August 1921.

Very detailed descriptions of the ovaries of 36 birds including various breeds of domestic fowls, water-fowl and wild birds. The object of the

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red blood corpuscles always contain a little calcium. The following figures give the milligrams of Calcium (Ca) found per 100 cm³ of the blood examined (citrated blood).

Species	Entire blood	Plasma	Serum	Red corpuscles
Man	7.15	9.34	9.39	1.23
Dog.	7.57	10.12	10.57	1.13
Horse	7.71	10.57	10.57	0.97
White rat	6.77	8.60	8.66	1.11
Fowl	7.30	9.19	9.23	1.60
Rabbit	8.43	9.92	10.01	1.14
Cat	7.15	9.83	9.31	0.83
Goat	8.07	10.13	10.63	1.09
Guinea-pig.	6.02	7.68	7.84	0.98
Sheep	8.10	10.80	10.97	1.23
Ox	6.43	8.31	8.37	1.13
Pig	7.12	9.22	9.30	1.44

MAZZOCCO and BUSTOS MORON have found that there is a real, though slight decrease in the serum calcium during the pregnant or puerperal condition. The amount of calcium is no proof of pregnancy, nor does it give any information as to the existence or gravity of accidents occurring during pregnancy. (*Ed.*)

researches was to determine whether the ovary of a very productive hen, with a winter record of from 75 to 115 eggs, contains a larger number of oöcytes than that of a hen laying only 10 to 15 eggs a year, and none in the winter.

TABLE I. — *Variation in Fecundity of the Birds in Relation to the Number of Visible Oöcytes.*
(Biometric Constants).

	Breed or species	Mean number of visible oöcytes	Standard deviation	Coefficient of variation
owls	White Leghorn	2476	705	28.5
	F_1 Cross breed fowls	2415	274	11.4
	Barred Plymouth Rock fowls	1615	433	26.8
	For all the fowls av.	**1906**	**615**	**32.3**
We fc	Toulouse geese	1489	432	29.0
	Pekin ducks .	1068	129	12.1
	For all the domestic water-fowls av.	**1279**	**382**	**29.9**
	Guinea-hens	676	90	13.3
Wild birds	Crows . . .	764	41	5.8
	Kingfishers	376	129	34.3
	For all the wild birds av. . .	**504**	**235**	**46.7**
	Id., including guinea hens . . .	**553**	**219**	**39.6**

It has been found, as is shown by Table I, that in general, the mean number of visible oöcytes in the ovaries of different kinds of birds reflects the normal fecundity or laying activity of the same species of birds. This relation does not hold with any exactitude or regularity for differences in fecundity between individual birds.

TABLE II. — *Constants From Regeneration Experiments.*

Group	Total visible oöcytes		
	Mean	Standard deviation	Coefficient of variation
Barred Plymouth Rock (portion of ovary removed)	663 ± 83	246	37.1
Barred Plymouth Rock (regenerated ovary) . . .	1487 ± 110	348	22.1
Total . . .	**2150 ± 183**	**543**	**25.2**
Barred Plymouth Rock (normal)	1615 ± 81	433	26.8
Cornish Indian Game (portion of ovary removed)	1088 ± 79	234	21.5
Cornish Indian Game (regenerated ovary)	1523 ± 146	432	28.3
Total . . .	**2611 ± 189**	**561**	**21.5**
Cornish Indian Game (normal)	1550	—	—

In Barred Plymouth Rocks, the number of visible oöcytes increases with the advancing age of the bird within the limits of 6 months and 36 months.

In another series of experiments on ovarian regeneration it was discovered, that by removing a portion of the ovary and causing it to regenerate, the total number of oöcytes developing to visible size is increased from 33 to 68 % over the number which develop in the normal unoperated bird. Table II gives data showing this increase in the oöcytes produced by the removal of a portion of the ovary.

1244 - **Estimation of the Digestibility of Foods Containing Cellulose: Experiments Made in Germany.** — SEMMLER, F. W. and ARINGSHEIM, H., in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCIV, Parts, 1-2, pp. 85-96, 4 Tables. Berlin, August 1919; Summarised in *Biedermanns Zentralblatt*, Year I, Part 7, pp. 270-272. Leipzig, July 1921.

The authors in the course of their researches on the digestibility of a food containing cellulose, came to the conclusion that WEENDE's method (1) which is customarily used for the quantitative estimation of the crude cellulose content of a food, cannot serve as the sole basis for the determination of its digestibility.

Good results have been obtained by direct and indirect estimation of the lignin.

The direct method, according to WILLSTAEDTER, consists in determining the water, ash, crude protein, pentosans, cellulose and lignin (total analysis). The samples of the foods containing cellulose are treated repeatedly with 40 % hydrochloric acid at low temperatures (in freezing chamber). They are then left to digest for 2 × 24 hours, and the residue, soaked in water until a neutral reaction is obtained; by this means the lignin content can readily be estimated.

It can also be determined indirectly by WAENTIG and GIERSCH's method of finding the chlorine index (" Chlorzahl "): 10 gm. of the substance the digestibility of which is to be determined are placed in a chloridising vessel with 25 cm^3 of water. The weight of the receptacle having been found, chlorine is introduced until the right weight is reached.

The increased weight, minus the amount of chlorine absorbed by the water used to moisten the substance (100 cm^3 representing 0.70 of chlorine), when multiplied by 10, gives the chlorine index: by subtracting 1.34, the exact lignin content of the cellulose food is then obtained.

The comparative analyses made by the authors agreed in general very well, except in the case of straw disintegrated by the BECKMANN method, and this discrepancy they are unable to explain.

When it is a question of a total analysis (" Gesamtanalyse "), a high lignin content (e. g. 20 %), in a natural product (" Naturprodukt ") indicates low digestibility not exceeding 50 %, whereas in the case of a product treated with alkalis (" Kunstprodukt, ") a high lignin content does not prevent a greater digestibility (up to 75 %) for the crude cellulose. It must be remembered always that the digestibility of the organic matter is in inverse proportion to the amount of lignin contained in the food.

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(1) See *R.* March 1921, No. 314. (*Ed.*)

From the total analysis, and by comparison with other foods of known nutritive value, certain conclusions can be reached as to the digestibility and starch value of a cellulose food, especially one that has been disintegrated by alkalis, which will suffice at all events to settle the preliminary question whether a feeding experiment is necessary.

1245 — **Experiments Carried Out in Germany on Sheep and Pigs to Determine the Food Value of Some Dried Beer Yeasts** (1). — HONCAMP F., in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol XCVI, Parts 3-4, pp 143-206. Berlin, 1920.

The author has analysed and used in feeding experiments dried beer yeasts obtained by 4 different processes of manufacture namely: 1) the Max OSCHATZ system, Dresden — 2) BUTTNER and MEYER's system, Urdingen near Duisbourg (Rhineland) — 3) TATOSIN's system (Trocknungsanlagengesellschaft), Berlin. — 4) Vacuum process ("Vacuumverfahren") of Emile PASSBURG, builder, Berlin. Experiments were made also in the utilisation of "Hefetrub" (the deposit formed in beer vats and coolers) as a food for sheep and pigs.

The content in crude nutritive substance of the dry yeasts, and of "Hefetrub" were as given in the following table.

Content in crude nutritive matter of the 4 kinds of dried yeast and of "Hefetrub".

	Organic matter	Crude protein	Refined protein	Nitrogen free extracts	Crude fats	Ash
	%	%	%	%	%	%
Yeasts:						
Oschatz system .	99.65	48.07	41.61	13.59	0.99	7.35
Tatosin »	92.35	57.65	51.18	33.10	1.60	7.65
Büttner » . .						
and Meyer	92,58	55.52	50.30	35.72	1.34	7.42
Passburg system . .	89,41	55.24	17.50	32.42	1.75	10.59
« *Hefetrub* »	91,39	55.45	39.63	31.17	4.17	8.61

In the experiments with sheep fed with a supplementary ration of lucerne hay no difference in favour of any of the drying methods was observed. The protein digestibility of the various system was as follows:— Oschatz 88.8 % — Büttner 91.7 % — Tatosin 93 % — Passburg 91.5 %. — "Hefetrub" 72.9 %. Similar results as regards protein were obtained in the pig-feeding experiments, but the nitrogen free substances were turned to better account by the pigs than by the sheep. A considerable difference was noticed in the case of "Hefetrub" only, its digestibility coefficients being as follows for sheep and pigs respectively: crude protein, 79.9 and 62.7 % — nitrogen free extracts, 71.4 and 54.5 % — Organic matter, 66.4 and 53 %.

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(1) See *R.* Feb. 1915, No. 204. (*Ed*)

In the sheep fattening experiments, it was found as a rule, that given an equal quantity of digestible protein and starch values in the basal ration, dried yeast fed as a supplementary ration, though rich in protein, did not have the same effect upon the live weight and quality of meat and fat as a mixture of sesame cake and ground cotton-seed cake.

Since, however, the differences were but slight, it must be admitted that they should be attributed to the better or worse digestive capacity of some of the animals, composing the various groups fed with dried yeast This view is confirmed by the fact that in the group given dried yeast as a supplementary ration, the results of the experiments were almost equal to those in the case of the two groups fed with a mixture of sesame cake and cotton seed cake.

In a second experiment in fattening sheep, dried yeast proved equivalent to soy-bean flour as regards increase in the live-weight.

In a pig fattening experiment, the effects of dried yeast and fish meal were compared. The latter proved superior as regards live weight, producing a daily increase of 0.663 kg. per head as against 0.637 kg. with dried yeast. No difference was observed in the quality of the meat.

1246 - **Effect of Degerming on the Fattening Value of Maize; Experiments Made in Hungary.** — WEISER St, in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol XCVII, Parts 1 and 2, pp. 93-110. Berlin, November 1920.

The output of maize oil in Hungary which was very small before the War, assumed considerable proportions during the War, on account of the scarcity of animal and vegetable fats.

As the extracted germ is richer in nitrogenous substances, crude fats and mineral matters than the whole seed, degerming causes a loss in these materials

The authors with the object of determining how far these losses affected the value of degermed maize in fattening stock, calculated first the deficiency produced by abstracting from 1 quintal of maize 10 kg. of germs containing 24 % of oil, and then proceeded to make feeding experiments on pigs on the Bábolna and Kisbér estates.

These experiments showed, that degerming has but little influence upon the fattening properties of maize (1). The same results were obtained as regards increase in live weight and quality of fat, when 103-104 kg. of degermed maize were fed instead of 100 kg. of entire maize the basal ration being maintained.

1247 - **The Chemical Composition and Food Value of *Monilia coerulea* Hay. Experiments Made in Germany.** — HONCAMP F. and NOLTE O., in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XVIII, pp. 91-95. Berlin, 1919; Summarised in *Biedermanns Zentralblatt*, Year 1, Part 3, p. 105. Leipzig, March 1921.

Molinia coerulea flourishes on damp sandy soils, as well as on the peaty soils of high-moors and meadow-moors.

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(1) The author was able to estimate the maximum decrease in nutritive value at only 3.5 %. (*Ed.*)

The hay is regarded as of inferior quality, and has hitherto been used for litter only.

In the authors' feeding experiments, the first sample of this hay was so much lignified, that the sheep tested refused to touch it, even after fasting for several days, whereas a Russian native horse (Panjepferd) ate it readily.

Molinia coerulea when cut very young, and at once dried was eaten without the slightest hesitation. Its crude nutritive content regarded as percentage of dry matter is as follows: organic matter 94.58 — crude protein 15.34 — refined protein 15.11 — nitrogen-free extracts 50.67 — crude fats 2.33 — crude cellulose 26.24 — refined ash 5.42. The following percentages of these substances were digested on an average : organic matter 65.5 — crude protein 71.8 — nitrogen-free extracts 64.9 — crude fats 27.9 — crude cellulose 66.3. *Molinia coerulea* hay is thus very rich in protein, but poor in crude cellulose. From the above coefficients of digestibility, the starch value of this forage is 30.6, which is equal to that of good quality meadow hay with a high protein content. When lignified, it should be used for litter only.

1248 - **Variability in Domestic Animals and the Value of Statistics to Biological Researches Applied to Animal Breeding; Researches Made in Germany** (1). — FEIZE, E., in *Fühlings Landwirtschaftliche Zeitung*, Year LXX, Parts 13 14, pp. 259-271, 3 diagrams, 3 tables. Stuttgart, July 1921.

Researches on biological genetics hitherto made have been chiefly concerned with Mendel's theory as applied to the heredity of characters of little importance from the standpoint of scientific stock-breeding. The greatest progress has been made in the study of the transmission of coat colour, whereas morphological characters, which are much more important to the breeder, have been neglected.

In a study on the transmission of the character, power of performance ("Vererbung von Leistungseigenschaften," in *Fühlings Landwirtschaftliche Zeitung*, 1914, part 8), ROEMER has already pointed out certain limitations affecting researches based on Mendel's laws. On the other hand, the theory that power of performance cannot be correlated with body measurements (2), is still the subject of much discussion. The author hopes that analysis based on statistics of variations will throw some light on the question. Attention should be directed to the behaviour of certain groups of biotypes or "elementary races" (GOLDSCHMIDT), rather than to a supposed correlation existing between shape and power of performance.

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(1) An exhaustive bibliography on this question is to be found in the work of the same author entitled "Über korrelative Variabilität bei Haustieren" in *Fühlings Landwirtschaftliche Zeitung* Year LXX, Nos 3-4, pp. 61-69, February 1921, summarised in *R.* July 1921, No. 739. (*Ed.*)

(2) See *R.* July 1921, No. 739. (*Ed.*)

In analysing the old conception of selection, the author remarks that the strong predilection shewn by practical breeders is founded on the everyday experience, that by means of systematic breeding, the progeny generally become superior to the original stock. This is easily understood, seeing that most stock-breeders have not the opportunity of observing a large mass of material, and hence are not able to understand that progress from the ordinary stock-raiser's standpoint in no wise signifies a displacement of the typical characters of a form, but merely a segregation of lines.

On the other hand, very little is yet known as to the number and extent of the mutations occurring in stock, especially as regards most morphological characters. It is probable that many mutations of this class are part of the typical deviation of the form as a whole, and therefore should not be regarded as extreme variations. Only a succession of generations can show if they really constitute a new line distinct from the genotypic point of view, and capable of transmitting the recently-acquired character to their progeny.

TABLE I. — *Hanover Mares (Half-blood). Height at Withers.*

Limits of classes Height at withers in cm.	No	Totals	Limits of classes Height at withers in cm.	No	Totals
148.5			161.5		
	2			309	
149.5		2	162.5		1933
	9			277	
150.5		11	163.5		2210
	11			231	
151.5		22	164.5		2441
	21			183	
152.5		43	165.5		2624
	28			160	
153.5		71	166.5		2784
	57			117	
154.5		128	167.5		2901
	87			62	
155.5		215	168.5		2963
	147			30	
156.5		362	169.5		2993
	177			22	
157.5		539	170.5		3015
	250			17	
158.5		789	171.5		3032
	226			13	
159.5		1015	172.5		3045
	338			1	
160.5		1353	173.5		3046
	271				
		1624			

TABLE II. — *Westphalian Mares.* — *Height at Withers.*

Draught (Arbeitschlag)			*Trotters* (« Edelzucht »)		
Limits of classes Height at withers in cm.	No	Totals	Limits of classes Height at withers in cm.	No	Totals
147.5	2		146.5	1	
148.5	3	2	147.5	3	1
149.5	9	5	148.5	6	4
150.5	8	14	149.5	13	10
151.5	26	22	150.5	21	23
152.5	36	48	151.5	29	44
153.5	31	84	152.5	44	73
154.5	47	115	153.5	57	117
155.5	65	162	154.5	89	174
156.5	66	227	155.5	96	263
157.5	97	293	156.5	121	359
158.5	97	390	157.5	100	480
159.5	99	487	158.5	94	580
160.5	81	586	159.5	111	674
161.5	75	667	160.5	99	785
162.5	59	742	161.5	83	884
163.5	35	801	162.5	49	967
164.5	40	836	163.5	65	1016
165.5	32	876	164.5	38	1081
166.5	7	908	165.5	27	1119
167.5	12	915	166.5	20	1146
168.5	3	927	167.5	5	1166
169.5	1	930	168.2	6	1171
170.5		931	169.5	3	1177
171.5			170.5	3	1180
			171.5		1183

The author with the object of obtaining information regarding the general behaviour of the forms, has made an exhaustive study of the variability of horses from Hanover and Westphalia. He does not take into account questions of heredity, but bases his work on statistics of variation, a method already adopted by WALTHER (1), SCHMIDT B. (2), STROEVER (3) and other authors.

The data respecting the height at withers given in the appended tables are taken from the Hanover Horse Stud Book (Vols. 2-3) and the First-Register of the Westphalian Horse (Vol. 8).

The author gives the distribution curves of the 3 types of horse (4) in the various classes established according to the height at withers; he has also determined the mean value (M), the typical variation (σ), as well as the coefficients of variation. The method of calculation is given in detail tail (5).

When M and σ are known, it is possible to calculate the probability of the occurrence of the different classes of height.

In the case of fluctuating variations, the limits $M + \sigma$ and $M - \sigma$ represent the points where the largest number of variations occur.

The values determined are as follows:

	Mean value	Typical deviation	Coefficient of variation
Hanover horses.	161.143 cm ± 0.071	± 3.936 cm	2.443
Westphalian horses			
a) Trotters.	158.812 cm ± 0.134	± 4.396 cm	2.768
b) Draught horses. . . .	159.219 cm ± 0.129	± 3.953 cm	2.264

Outside the limits $M + \sigma$ (157.207 to 165.079 cm.), there are in the Hanover horses about 750 variations, that is to say, only ¼ of the whole number. This fact proves the importance of the calculation of the typical deviation in estimating the different measurements of animals. This is the only method that makes it possible to predict the transmission of quantitative characters, though it does not exclude hereditary analysis extending through several generations.

(1) WALTHER, Beiträge zur Kenntniss der Vererbung der Pferdefarben. Hanover, 1912.

(2) SCHMID B., Vererbungsstudien im Hauptgestüt Trakehnen. Hanover, 1913.

(3) STROEVERR, Die Vererbung der Haarfarbe beim Vollblut. Berlin, 1917.

(4) Whereas the type of Hanover horse is already fairly fixed (in the zootechnical-biological sense), the Westphalian breeders have a good deal to do before obtaining uniformity of type. Both among trotters and draught-horses, stock animals are still found which have come from the most different countries (Hanover, Great Britain, United States, France, East Prussia, Belgium, the Rhineland and East Frisia). As the author only wished to study individuals of pure Westphalian descent, the number of animals available was reduced to about 1000. The author has however been able to prove that the typical formation of the series has not been modified in any way. (*Ed.*)

(5) σ indicates the variations within the group. As regards its calculation see also *R.* July 1921, No. 739, and *R.* August 1921, No. 836. (*Ed.*)

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From a curve showing the distribution of Westphalian trotters (both as observed and calculated), the author found, that the horses used by him in these researches were very suitable subjects for theoretical calculations.

Conclusions. — What do the curves plotted and the statistical data collected show from the stock-breeding and biological standpoints ? There is no doubt that in the three cases there is a mixture of forms. This can be explained in the Westphalian horses by the their mixed descent. This explanation does not hold good for the Hanover horses, which from the stock-breeders' point of view, are already more homogeneous. If the probable influence of age and environment are left out of account, the most perfect zootechnical homogeneity does not in any way imply biological homogeneity of form. This fact is clearly demonstrated by the curves reproduced in the text. The asymmetry of the curves depends upon the presence of very different hereditary units (genotypes) whereas the breed (" race ") from the zoo-technical standpoint may appear homogeneous. The different genotypes (races, lines, populations) themselves again represent a fusion of various ancestral forms of which the number and prepotency cannot be exactly determined in the case of the Hanoverian or of the Westphalian horses.

It would be possible to decide, by means of special researches based on Mendel's theory whether the different sectors of the curves correspond, as regards genotypic constitution, to constant forms (D and R respectively), or to intermediate forms (D R).

1249 - **Stock-Breeding in Galicia (Spain).** (1). — ARMENDARITZ, J. G. (Provincial Stock Inspector of Lugo), in *La Industria pecuaria*, Vol. XXII, No 709, pp. 435-437. Madrid, October 1, 1921.

Stockbreeding is the fundamental industry of Galicia (Province of Lugo), and the main source of its wealth. The total number of cattle, sheep, goats, horses, and pigs amount to 1 100 000 head, and poultry to 600 000 head ; the value of all the stock is 170 millions of *pesetas*.

The cattle of Galicia provide Barcelona with most of its meat supply, and also furnish a good deal of meat to Madrid. A cattle-train leaves Lugo daily for the interior.

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(1) Spain is an eminently agricultural country : 84.45 % of the ground being classed as fertile. Of this 35.5 % is devoted to agriculture and horticulture, 2.5 % to vines, 2.0 % to olive plantations, 22.2 % to fruit trees, while 25.3 % consists of natural pasture. Small and average-sized holdings predominate ; they were constituted during the 19th century.

In 1920, the areas under the most important crops and the yields obtained were as follows. wheat 4 198 000 hectares, 38 327 000 quintals — barley 1 768 000 hectares, 20 012 000 quintals — oats 650 000 hectares, 5 571 000 quintals — rye 737 000 hectares, 7 153 000 quintals — maize 478 000 hectares, 7 147 000 quintals — millet 2000 hectares, 21 000 quintals — mixed cereals 44 000 hectares, 296 000 quintals — rice 49 000 hectares, 2 950 000 quintals — coloured haricot beans 198 000 hectares, 1 865 000 quintals — white haricots 323 000 hectares, 1 913 000 quintals — peas 62 000 hectares, 429 000 quintals — Chick peas 230 000 hectares, 1 422 000 quintals — lentils [illegible]3 000 hectares, 257 000 quintals — common vetch 200 000 hectares, 1 407 000 quintals — other vetches 67 000 hectares, 583 000 quintals.'

In 1920, there were 2 141 000 hectares under vines ; they produced 43 438 180 quintals of grapes from which were obtained 32 128 850 hectolitres of ordinary red and white wines.

The sheep and goats that stock the markets of Northern Spain come principally from the mountainous part of the country; these animals are in great demand because owing to their small size, they furnish for the same net weight of meat, double the quantity of offal and skins obtained from other breeds.

The chief aim of the horse-breeder is to rear mares which are mated with donkeys of the Zamora breed, in order to insure a plentiful supply of mules.

Pigs are the most generally kept domestic stock and their meat, which is very delicate, is the staple animal food consumed by the rural population.

The author lays stress on the desirability of improving the poultry breeding, and establishing genuine industries founded on animal products, as at present this branch of trade is practically non existent.

As regards methods of improving the live-stock, the introduction of foreign cattle has never given good results and in order to succeed, it would be necessary to devote a considerable amount of special attention to the question. In the author's opinion, such efforts would be better directed to the selection of native breeds with the object of fixing and perpetuating desirable qualities. He advises the holding of Shows and Competitions, the formation of artificial pastures, and preventive inoculation against epizootic disease.

During the last 10 years, the systems of sales have become far more practical, and there is a marked tendency towards the constitution of co-operative societies in order that the meat may be sold directly to the centres of consumption.

The olive plantations occupied 1 590 000 hectares and produced 18 421 950 quintals of olives from which 3 417 000 quintals of oil were extracted.

Amongst the other products should be mentioned esparto, hemp, flax and vegetables; a considerable number of oranges and hazel-nuts are exported; wine making and fruit-growing are important industries. Silkworm rearing is practised in Valencia, Murcia and other provinces. There are 28 factories of cane sugar and 46 of beet root sugar; in 1919 the former produced 6 278 tons of sugar and the latter 104 949 tons.

In 1919, the number of stock was estimated as follows: horses 594 351 — mules 1 069 408 — donkeys 1 014 026 — cows 2 396 573 — sheep 19 337 427 — goats 3 970 656 pigs 6 228 964 — camels (in the Canary Isles) 5083.

At Cáceres and Huelva, there are rich deposits of phosphates, which in 1919 yielded 25 095 tons worth 755 782 *pesetas*. There are other important industries, especially in Catalonia; the cotton industry (which employed 2 614 500 bobbins in 1910), the wool industry (662 000 bobbins), paper making (about 144 factories), cork (in 1917, 60 000 tons of cork were worked worth 58 millions of *pesetas*). *The Statesman's Yearbook* 1921. Macmillan and Co., London. (*Ed.*)

1250 – **The Cattle of Sardinia** (1). — DORIA M. (Osservatorio zootecnico della Provincia di Sassari), in *Allevamenti*, Year II, No. 9, pp. 274-276, 5 figs. Palermo, September 1, 1921.

Cattle-breeding has made great progress of late years in Sardinia.

There are 3 breeds of cattle in the island: 1) the Plain breed, which to a large extent consists of imported animals descended from the Sicilian draught cattle; 2) the Milk breed, descended from the Brown Swiss breed; 3) the Mountain breed (native).

In Sardinia, cattle like all other domestic animals, are kept in the open. Even in places where, in order to obtain some premium or subsidy granted by the Ministry of Agriculture, the owners have constructed byres or scientific cow-sheds, these remain empty.

The Plain breed is found in Planargia, and Campidano d'Oristano. These are essentially draught animals, and have a special aptitude for their work. The coat is wheat-coloured, black or coal black, the cattle are strongly built, symmetrical and well-shaped for draught purposes.

The Milk breed, which is thoroughly acclimatised, and to be found throughout the island, may be termed Schwyz-Sardinian. The centre of its production is Ozieri. These cows are symmetrical with soft, thin skin, and well-shaped udders. Although living in the open, and having to subsist on the natural herbage, which at certain seasons is very scanty, they yield plenty of rich milk from which excellent butter, a much-prized article of export, is made.

The Mountain breed, or the Sardinian breed proper, much resembles the cattle in the mountains of Dalmatia. The animals are of small size, with delicately-shaped muzzle, short, very pointed horns, small, bright eyes and variegated coat. They weigh on an average not more than 80 to 90 kg. The cows give little milk, but their flesh is excellent. These cattle live half-wild in the lentisk woods amongst wild-boars and goats and no breeder has ever tried to improve them.

The author lays stress on the importance of introducing cattle-feeding into the island, in order to insure that the stock is fed regularly throughout the year: he also points out the advantages of partial housing.

1251 – **The "Tuxer" (2) A Race of Tyrolese Cattle in Process of Extinction.** – KUBAT (Chief Inspector of Stock, Innsbruck) in *Suddeutsche Landwirtschaftliche Tierzucht*, Year XII, No. 14, pp. 158-159, Munich, July 1921.

The "Tuxer" race of cattle, which at the end of the nineteenth century was largely represented in the Unterinntal and its transverse valleys from Innsbruck as far as the Italian frontier, is now only to be found in some mountain communes of the district of Halle (Klein-and

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(1) See: *R.* ZAPPA, The Cattle Industry in Italy at the Present Day. *R.* May 1914, pp. 598-606, and *R.* June 1914, pp. 712-716. (*Ed.*)

(2) Or, according to SANSON "Duxer", a word signifying coming from Dux, a place in the Tyrol. (*Ed.*)

Grossvoldersberg, Kolsassberg, and Weerberg), and in the cow-sheds of a few breeders in the district of Innsbruck and the Zillertal (Sprengen, and Fügen).

These cattle although formerly much prized and sought after, have been gradually replaced by the spotted Unterinntal, the Simmental and the Grey-brown Tyrolese breeds.

The Tuxer cow though very strong and hardy, is not a good milker, and at the same time the animals of this breed grow slowly, and cannot compete with the quickly developing Simmentals, or the brown-grey races with heavy milk yield.

They possess the characters of their ancestor *Bos taurus brachycephalus*, and are nearly related to the *Zillertal cattle* (another race that is gradually dying out), and also to the *Pustertal* and *Pinzgau breeds*, their geographical extension being very considerable.

The chief coat colours of Tuxer cattle are dark-brown, brownish-black, or black with a light stripe down the spine. The belly is white; the fore-limb and lower portion of the flank sometimes show traces of white spots. The muzzle, tongue, hoofs and horns have a dark blue pigmentation.

The back in the region of the hindquarters is sloping; the tail being set very high, in the manner characteristic of the primitive Alpine races.

The thorax is enormously developed, and in circumference exceeds that of any other European cattle, thus conferring an unusual degree of resistance to tuberculosis.

These animals fatten well and possess remarkable powers of digestion, but their milk production is not sufficient to satisfy present-day requirements.

Breeders formerly devoted their attention principally to obtaining very strongly-built and heavy animals (600 kg.), and took no pains to improve the milk yield, on account of the small demand for milk or dairy produce.

The cows are very robust and excessively pugnacious; owing to the latter quality organised cow-fights have become a regular sport in the Alps.

In order to prepare the animals for these popular entertainments, the cows were frequently not thoroughly milked. This continual partial suppression of the mechanical function of the udder for many generations, explains the low milk yield of the race.

Whereas however formerly a good fighter ("Moarin", "Hagmoarin"), was more valuable than a good milker, the combative qualities of a cow are now less appreciated, and hence the milk yield is being improved; the average production before the War had risen to 3232 litres per annum. In the case of cows fed on a small quantity of concentrates, in addition to their ordinary ration of hay and green forage, the fat content of the milk is particularly high (3.38 %).

The author in conclusion draws the reader's attention to the great resemblance between the Tuxers and the cattle of the Val d'Hérens (Canton du Valais, Switzerland) (1) as regards shape, performance and qualities. He also mentions the interesting and striking fact, that cow-fights are the custom in the Valais, the victorious animal being dubbed queen of the herd.

It is therefore probable that these two races of cattle are very near akin, and this hypothesis would seem to be confirmed by the fact, that the head of a bronze bull, with all the characters of *Bos taurus brachycephalus*, found in the ruins of the Roman citadel at Martigny (Valais), proves the existence at a still earlier date, of a breed of cattle of which the races still preserved in the Valais and Tyrol appear to be the last representatives.

1252 - **Zebu Breeding in Madagascar** (2). — FAUCHÈRE A., (Inspecteur général des Services agricoles et forestiers de Madagascar), in *Révue d'Histoire naturelle appliquée*, Vol. II, No. 5, pp. 129-132, and No. 6, pp 177-181. Paris, May and June 1921.

I. *Condition and Value of the Stock*. — The products of live stock breeding form an increasingly important item every year in the general trade returns of Madagascar. Thus, whereas in 1907 the value of exported cattle and their produce was 6 591 000 francs only, in 1919 it had already risen to 90 243 000 francs. These figures prove that cattle-rearing is an important source of profit to the island.

The last census, taken in 1918, shows that the Madagascar herds contained nearly 5 million head, the provinces of the West and South-West being the richest in cattle A comparison of the number of the latter with that of the population, shows that Madagascar possesses a larger proportion of cattle per human unit than any other of the stock-breeding countries.

The proper conditions of cattle rearing are little known in the Island, and the most rudimentary methods are followed.

The entire herd composed of zebus, is in the hands of native herdsmen of simple habits and needs.

In 1895, the year of the conquest of Madagascar, no trouble was taken to turn the stock of cattle to full account. Although as many as 400 000 head might have been utilised for local consumption, barely ⅓ of this number were actually supplied, the rest of this potential wealth being either lost or wasted. The price of the zebu was very low, a large ox fetching from 50-60 francs only in most districts, even as late as 1913.

One cause of the small number of cattle, the ritual sacrifices, still exists; formerly it assumed such proportions, that Radama I, towards the end of his reign, limited the number of oxen to be killed on the occasion of the funerals of the Mirana, in order to prevent the destruction of the Imerina herd.

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(1) For further information regarding the Hérens breed and its relationship with the " Duxer " see: 1) Dr S. BIÉLER. Les races Suisses de betail bovin, in the *Vème Congrès international d'Agriculture, Lausanne* 1898, *Mémoires et Documents*, pp. 409 411 — 2) WERNER H., *Die Rinderzucht* pp. 452 and 455. Berlin 1912, published by Paul Parey — 3) HANSEN I, *Lehrbuch der Rinderzucht*, pp. 284 and 335. Berlin, 1921, published by Paul Parey. (*Ed*)

(2) See in *R*. Jan. 1919, pp. 1-12, the Original Article by GEORGES CARLE entitled *Stock Breeding in Madagascar*. (*Ed*)

Since the War, the price of zebus has considerably increased, and the native breeder has learnt the value of his cattle; the total value however of the produce of the herd is scarcely 80 million francs, for though beef costs 3 francs a kg. the breeders get less than 1 franc.

II. *Breeding Conditions and Methods.* — No care is given to the animals, which remain always at grass, and live an almost wild life, exposed to the inclemency of the weather, the owner scarcely troubling even to collect and mark them from time to time.

The cattle are left to fend for themselves. During the rainy season they have abundance of food, but the owners never think of collecting reserves of forage in these months of plenty, in order to tide over the frequently very long and deadly periods of dearth that occur during the dry season.

No choice is made with a view to obtaining good animals for breeding purposes. Calves receive no more attention than adults, and as there is but little milk at their disposal, begin to eat fine grass at a very early age, so that their rate of mortality is high.

The appearance of the herd varies much according to the season. During the rainy months, and up to June and July, it is most satisfactory, there being a relatively large number of fat animals, the hump they bear on their withers is full of fat, and its large size is an indication of their well-being, whereas in the dry season, the cattle become excessively thin.

At this time, the beef-canning factories are obliged to suspend their operations. Many of the cattle are so weak from want of food, that they offer no resistance to disease, and fall easy victims to bacterial anthrax, and tuberculosis.

The Madagascar cattle are small and mature late, not reaching full growth before 7 or 8 years of age, when they may weigh as much as 400 kg., or even more, but the weight of the full-grown zebu never exceeds 300 kg., unless it is specially fattened, as is sometimes the case in Imerina. The process consists in taking adult animals from the herd, and stall-feeding them till they reach the required weight. In this manner, oxen weighing 600 and 700 kg. can be obtained and these are especially suitable for the preparation of frozen meat. Only a few thousand animals however are treated in this way. The meat yield varies from 45 to 60 % of the live weight, according to the condition of the zebu at the time of killing.

The number of head is small in proportion to the area of grazing ground, there being only one animal to 8-10-12-15 hectares. Hence the return from the Madagascar herd is low; it is estimated at about 5 %.

III. *Measures for the Improvement of Cattle Breeding.* — Now that the Madagascar ox has become a valuable animal, zebu beef finding a ready market in Paris, and other circumstances having combined to make the herd the chief source of the wealth of the Colony, it is necessary that the breeding conditions should be improved.

[1252]

To this end the author advises the re-organisation of the Veterinary Service, which at present is not in a position to control even epizootic anthrax, a disease killing at least 100 000 zebus annually.

He has been able to set on foot the building of a laboratory for the use of the Veterinary Services, and of a School for Assistant Veterinary Officers.

In addition, a model farm has been instituted at Antsirabé to take the place of the old Iboaka farm suppressed in 1906. Many buildings have already been constructed, and as soon as the condition of the crops permits, stock for breeding purposes will be turned out on the farm land.

1253 – **A New Method of Selecting Milch Cows.** – MAUPAS H., in *Journal d'Agriculture pratique*, Year LXXXV, Vol. II, No. 33, pp. 151-152, Paris, Aug. 1921.

The correlation, which according to recent researches, seems to exist between chest development and lactic secretion in cows, has long escaped the notice of breeders of milch kine, and instead of selecting for breeding such cows only as were generally symmetrical, it was at one time the fashion to choose animals in which the hind were far more developed than the fore quarters. Hence far from being considered as a defect, a poorly developed, or even narrow chest, began to be regarded as a beauty, while in the same animals a broad pelvis was another much admired characteristic.

The method devised by D^r Paul SCHUPPLI, Director of the School of Agriculture and of Stock Breeding at Grabnerhof (Austria), for classifying the animals to be registered in the Herd Book of the Society during the War has been applied on a large scale by the Gröbning Breeding Syndicate to the Pinzgau breed. Like all such methods, it is based on the general appearance of the animal, after which, this being the important point, the width of the chest is compared with the height at the withers.

Each animal in which the required characters of development are combined, is marked according to a very definite scale of points. The lowest mark that can be givin is 1, indicating that the chest width of the animal examined is $^1/_3$ of its height at the withers. When the chest measurement exceeds this amount (and is over $^1/_3$ of the height at the withers) the cow is credited with another mark for each centimetre of extra width.

As a rule mark 5, which denotes exceptional characters in the animal measured, is rarely given. Investigations carried out under the auspices of the Gröbning Breed Society have shown, that *very many cows were not credited even with 1 mark,* and that such animals *should be excluded from the Herdbook.*

The following Table gives some figures collected by MAYER, an agriculturist of Oberstuttern *before* and *after* this method of selection was adopted, and they seem to confirm D^r SCHUPPLI's views on the question. From 1916, MAYER measured his cows in the manner prescribed by D^r SCHUPPLI, and in consequence, reduced the number of head in his herd to 9; but the latter were all entitled to mark 5.

Year	No. of Cows	Average annual Milk yield	Average fat content of milk
—	—	—	—
1912.	12	2 557 litres	3.85 %
1913.	12	3 065 »	4.01
1914. . . .	12	2 914 »	4.03
1915.	11	2 866 »	4.29
1916.	9	3 507 »	3.97
1917.	9	3 404 »	4.28

It should further be mentioned, that 2 bulls belonging to MAYER and aged respectively 18 months, and 2 years, were marked 5 on their registration in the Herdbook.

The milk yields due to the application of this method are all the more interesting, seeing that the animals kept by MAYER received absolutely no concentrates (cake, grain, etc.) and during the winter were given two feeds of hay, or the aftermath of the natural pastures only per day, while in summer, they lived entirely on the grass they cropped on the meadows belonging to the farm.

Cows of the Pinzgau breed, reared on the mountains in Austria weigh 400 to 450 kg., and yield from 1200 to 1700 kg. of milk only each year; the cows of the valleys weigh from 650 to 750 kg., and give from 2000 to 2800 kg. of milk a year (Prof. WERNER), but even these figures are below those obtained at MAYER's farm.

D^r^ SCHUPPLI and the Breed Syndicates of his district advise the adoption of the above-mentioned measurement method, but also advise an examination of the animals to see whether they are normal as regards width of pelvis, depth of chest, body length, etc. In this connection, the proportions fixed for the milch cow by Prof. DECHAMBRE will be of the greatest use (occipital-coccygeal length as compared with oblique circumference of the chest; the distance between the haunches as compared with width of skull, etc.).

The author hopes that the new method of measuring described above will be tried in those districts of France which are especially interested in milk production.

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1254 - **Comparative Value of Root Ration and Silage for Dairy Cows; Experiments in England.** — OLDERSHAW, A. W., and SMITH, F. C., in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 7, pp. 614-621, tables 2, figs. 2. London, Oct. 1921.

In previous experiments it was found that a ration of 60 lb. of silage was equivalent to 60 lb. of mangolds and 7 lb. of straw chaff. There was very little difference in the amount of milk given by cows fed on the two rations.

Since then it has been claimed that owing to the fact that silage contains considerably more albuminoids than roots, it should be possible to reduce the quantity of expensive concentrated food fed when silage is being used.

Experiments were carried out in the Eastern Counties of England, where the system of ensilage has made great progress during recent years (1).

It appears from the results obtained that 60 lb. of oat and tare silage + 10 lb. barley straw chaff + 14 lb. kale (Marrow stem) + 4 lb. mixed concentrated foods (equal weights of decorticated cotton cake and dried grains), give about $^1/_6$ of a gallon of milk per cow less than 60 lb. of mangolds fed with the same quantity of barley straw and kale, but double the amount of concentrated foods. That is to say, 60 lb. of silage is not equal in milk producing capacity to 60 lb. of mangolds + 4 lb. of concentrated foods.

However as regards the cost of the silage ration in the production of milk, this was $^3/_4$ d. per gallon less than that of the root ration.

1255 - Effect Exerted Upon Milk Production by the Age of the Cow at the Time of First Calving (2). **Researches Made in Germany.** — I. SPANN (Weihenstephan, in *Deutsche Landwirtschaftliche Tierzucht*, Year XXV, pp. 261-262. Hanover, June 1921. — II. WOLF, in *Suddeutsche Landwirtschaftliche Tierzucht*, Year XVI, No. 10, pp. 109-110. Munich, May 1921.

I. — This question has not hitherto been made the subject of much careful investigation in Germany, and the results so far obtained do not allow of any definitive conclusions. The author with the view of making a contribution to the study of the problem, has examined and elaborated his observations made on 709 East Frisian cows, the figures being given in Table I.

TABLE I. — *Effect Upon Milk Production of the Age of the Cow at the Time of First Calving.*

First calving at 2 years of age			First calving at 5 years of age		
No. of Cows	Successive ages	Milk yield	No. of Cows	Successive ages	Milk yield
	years	kg.		years	kg
21	4	3628	17	4	3380
35	5	4143	142	5	3783
19	6	4399	118	6	4130
12	7	5017	106	7	4500
12	8	4922	84	8	4788
5	9	4472	52	9	4761
3	10	5198	30	10	4706
1	11	3950	24	11	4752
2	12	4550	14	12	4784
2	14	4460	9	13	4182
1	16	2510	—	—	—
Average 113	—	*Average* 4295	*Average* 596	—	*Average* 4377

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(1) See *R.* Aug. 1916, No. 880. (*Ed.*)

II. — Researches made on Allgäu cattle, and confirming the truth of Prof. SPANN's statement that the nearer the cows approach the close of their growing period, the greater is the average amount of milk they yield: this is shown by Table II.

TABLE II. — *Effect of the Age of Cows on Milk Yield.*

Age of cow at first calving	No. of cows observed	Annual yield of milk kg.	Fat %	Average number of lactation periods
Up to 28 months	30	2845	3.8	2.5
From 29 to 30 months. . .	646	2847	3.7	2.9
From 37 to 40 months. . .	396	2885	3.69	2.7

The relatively high milk yield of the 30 cows belonging to the first group is explained according to the author by the fact that they came from farms which were above the average, and in such cases the performance of élite parents comes into the reckoning; the animals had moreover grown excessively fast.

SPANN and WOLFF do not however consider the results obtained as absolutely conclusive, but think that investigations of this nature should be carried out on a much larger scale.

1256 - **Results of the Butter Competition at Dieppe, France, in 1921.** — LABOUNOUX (Directeur des services agricoles de la Seine-Inférieure), in *Journal d'Agriculture pratique*, year 55, Vol. II, No. 33, pp. 150-151. Paris, August 20, 1921.

The Butter Competition held this year on the beach at Dieppe is one of a series that the Central Agricultural Society of Seine-Inférieure has organized since 1906.

The results obtained confirm those of previous competitions in so far as they prove the need for a careful interpretation of the results of analyses of milk production.

The differences between the milk yield of different cows were sometimes most striking.

One kg. of butter was made from 16.215 kg. of milk given by one cow, but 26.659 kg. of milk were required in the case of another.

The variations in the fat content of the different milkings were also very marked.

With a general average of fat of 45 gm. per litre on the first day of testing, and 34 gm. on the second in the midday milkings, the fat content fell to 33.4 gm. per litre the first day and 30.3 gm. the second day, to rise again in the evening milking to 46.9 gm. and 48 gm. respectively.

The variations were still more noticeable in different milkings of the same cow, and even in the milk taken at the same hour on different days.

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(2) See *R.* Oct. 1916, No. 1049 and *R.* April 1917, No. 345 (*Ed.*)

Thus one animal, an excellent butter producer, gave the first day, milk containing only 9 gm. of fat in the morning, 66 gm. at midday, and 38 gm. in the evening, but the fat content of the milk next morning was 18 gm. In the case of another cow, the fat content of the milk was 3 times below 20 gm. (morning milkings) and 6 times above 70 gm. (midday and evening milkings); the maximum being 85.5 gm.

As regards butter yield, all the cows placed in the first class of the second section (cows that had all their second teeth), produced 3.039 kg. of butter in 48 hours; the second and third class animals gave respectively 2.944 kg., and 1.029 kg.

Nine cows gave an average of over 1 kg. of butter per 24 hours and the maximum milk production was 68.200 kg. in 48 hours.

The Competition also proved once again that perfect symmetry and exceptional milk-yielding capacity can be combined in the same animal.

All the cows entered for the milk and butter yielding tests of the Central Agricultural Society of Seine-Inférieure have also to pass the symmetry tests, and the prize is awarded to the animal classed highest in both lists.

At Dieppe, however, the prize was carried off by a cow classed third in the butter competition, and second in the symmetry competition.

The following Table gives the general results of the competition.

General Results of the Butter Competition at Dieppe in 1921.

Classes	No. of animals	Milk production per 24 hours		Butter production per 24 hours (gross weight)	Weight of milk used to make 1 kg. of butter
		weight	volume		
		kg.	litres	gm.	kg.
Prize winners:					
First	8	13 131	12 755	638.56	20.563
Second	18	22 291	21 683	1 072.33	20.787
Total	26	19 473	18 980	938.85	20.711
All the cows taking part in the competition:					
First	8	13 131	12 755	638.56	20.563
Second	24	20 560	19 994	960.20	21.112
Total	32	18 703	18 184	870.79	21.258

When these results are compared with those of the last competition, which was held at Yvetot in 1914, a perceptible improvement is noticed in the amount of butter made in proportion to the milk supplied.

This year, at Dieppe, the average for all the animals competing was 1 kg. of butter from 21.258 kg. of milk, whereas at Yvetot in 1914, 23.971 kg. of milk were needed in order to obtain 1 kg. of butter.

The excellent results obtained by the breeders of the Seine-Inférieure are chiefly due to the efforts of the Milk-Testing Syndicates, and must be attributed to their daily tests, combined with patient and strict selection.

Most of the cows taking part in the Butter Competition were, in fact, chosen from the élite animals registered by the two great Milk Testing Syndicates of Seine-Inférieure: the Normand-Cauchois Syndicate founded in 1908, and the Pays de Bray Syndicate dating from 1912.

It is much to be desired that such useful organisations should increase in number in all cattle-breeding districts.

1257 - **Milk and Butter Competition at Meknès (Morocco) in 1921.** — *Revue Agricole de l'Afrique du Nord*, Year XIX, No. 106, p. 254. Algiers, August 12, 1921.

Milk and butter competitions were held at Meknès for the first time in 1916, and have taken place annually since that date, with the exception of 1920.

The main points in the organisation of these competitions are as follows: they last 48 hours; the cows are brought to the place appointed, on the day before the competition opens, and the inferior milkers are weeded out by a preliminary test, and sent back, thus the maximum number reserved for the actual test is reduced to 40 or 50.

During the two days of the trial, the cows are milked at 6 in the morning, and at 5 30 in the evening. The milk is carefully weighed each time, and its fat content estimated by the GERBER method.

The sum awarded in prizes at each of these competitions is 1200 francs.

In 1921 there were 17 competitors.

During the two days' trial, the mean maximum and minimum milk yields were respectively 8.957 litres, and 6.050 litres. The average daily milk production of the 17 cows, which were the property of 13 natives, was 7.560 litres per head.

In 1919, the average was 7.600 kg., or practically the same, though there were 20 competitors.

In 1916, it was 5.95 kg. per head and per day, but the competing cows numbered 40.

At the 1921 Competition, two cows belonging to Europeans gave respectively 11 litres and 9 litres a day.

According to the GERBER test, the maximum butter production was 560 gm. in 24 hours for a cow placed in the fourth class at the quantity milk testing which had yielded during the 2 days an average of 5.612 litres daily.

The minimum (220 gm.) was produced by a cow giving an average of 6.287 litres a day. The average for all the 17 competing animals was 39 gm. per head and per day.

In the case of the best butter producing cow, 1 kg. of butter represented 15.350 litres of milk, and in that of the worst, 28.570 litres. The average for the 17 cows was 24.160 litres.

1258 - **Pig-Breeding in the Colony of Erythrea.** — TARANTINO G. B., (Osservatorio zootecnico della Colonia Eritrea, Asmara), in *Allevamenti*, Vol. II, No. 10, pp. 306-309, figs. 4 Palermo, October 1, 1921.

In the Colony of Erythrea, the settlers are engaged in domestic pig-breeding, keeping 3 or 4 animals both for their own use and for sale.

Until January 1921, there was, at Sembel (Asmara), a large pig-breeding farm belonging to the firm of *Torrigiani*, and annexed to a Canned Meat factory with a branch establishment at Debarea.

The Caserta breed is the one chiefly represented ; it is well acclimatised, and has the usual characters denoting hardiness ; long rather large, head, small almost straight ears ; black coat and silky mane ; somewhat slow in fattening, especially if the animals are kept at grass ; meat very delicate ; sows very prolific and excellent mothers.

This breed has become quite acclimatised and does not suffer at all from the altitude or climate of the plateau, whereas nearly all the recently imported animals suffer much from the change and often die. The author has also found that pigs born on the plains of Erythrea, if transported to the plateaux, are subject to various diseases, especially to those affecting the respiratory organs.

The author advises selection in preference to crossing as the best means of improving the pigs in the Colony. Crossing should only be effected experimentally with great care, and on a small scale, unless success justifies bolder measures. The Bureau of Colonisation has imported some boars from Reggio Emilia (Italy), but their progeny have not proved successful.

1259 - **Some Feeding Tests with Pigs in Australia.** — PERKINS, A. J., in *The Journal of the Department of Agriculture of South Australia*, Vol. XXIV, No. 12, pp. 981-987, 7. tables. Adelaide, July 1921.

THE NUTRITIVE VALUE OF PIG MEAL AND PIG COMPO (WASTE PRODUCT MEALS SOLD BY THE METROPOLITAN ABATTOIRS BOARD) (1) AS COMPARED WITH THAT OF SKIM MILK. — In these tests which lasted a fortnight, 12 young pigs were taken and divided into 3 groups. The animals received the daily rations given in Table I (page 1597).

In feeding value, ½ lb. of pig meal, or of pig compo corresponds with 5 ½ lb. of skim milk ; the nutritive unit of these two meals is slightly cheaper than that of skim milk.

The mean daily increases in live-weight of the different groups from January 24 to March 6 were as follows :

1) *Barley and skim milk :* Group *A*, 0.87 lb. — Group *B*, 1.02 lb. — Group *C*. 1.35 lb.

2) *Barley and pig meal :* Group *A*, 1.24 lb. — Group *B*, 0.73 lb. — Group *C*, 1.33 lb.

3) *Barley and pig compo :* Group *A*, 0.85 lb. — Group *B*, 1.07 lb. — Group *C*, 1.08 lb

It will be seen from the above results that the two meals in question are very effective substitutes for skim milk when the latter is not available, and that any farmer with no milk at his disposal, who grows grain, can rear healthy young pigs.

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(1) See *R.* May 1921, No. 544. (*Ed.*)

TABLE I. — *Daily Ration (in lb.) Fed to Young Pigs between January 24 and March 6.*

	Barley	Skim milk	Pig Meal	Pig Compo
January 24–Feb. 6:				
Group A	1.25	2.50	—	
» B	1.25	—	0.23	
» C	1.59	—	—	0.23
February 7-20:				
Group A	1.59	—	0.23	
» B	1.59	—		0.23
» C	1.93	2.50		
February 21–March 6:				
Group A	1.93	—		0.23
» B	1.93	2.50	—	
» C	2.27	—	0.23	

II. — RESULTS OF FEEDING SOWS ON THEIR LITTERS (UNTIL THE YOUNG PIGS WERE WEANED), WITH BARLEY AND WITH BARLEY + ABATTOIR MEALS (PIG MEAL OR PIG COMPO) RESPECTIVELY. — For these tests only 3 sows could be procured so that the results summarised in Table II cannot be regarded as definitive, taking into account the influence of individual temperament, etc.

The litter of sow A fed on barley alone, although containing one piglet less than that of the sow to whose ration pig-meal had been added, attained, during the period of 63 days, mean daily individual increases of 0. 27 lb. only as against increases of 0.41 lb. for the litters of sows supplied with pig-meal and pig compo respectively.

TABLE II. — *Feeding Sows on Barley or on Barley + Abattoir Meals Respectively.*

	Sow *A*	Sow *B*	Sow *C*
	Barley only	Barley+1¼ lb. pig meal daily	Barley+1¼ lb. pig compo daily
Number of piglets	8	9	8
Original total weight of piglets	16.39lb.	18.46lb.	21.29lb.
Mean original weight per head	2.05	2.05	2.66
Total weight at weaning	77.79	123.83	115.44
Mean weight per head at weaning	9.73	13.76	14.42
Total increase in weight (63 days)	61.41	105.27	94.15
Mean increase per head (63 days)	7.68	11.71	11.54
Mean increase per day	0.12	0.19	0.19

The results are equally satisfactory from the point of view of cost of production. When pig-meals formed part of the ration of sows on litters, the young animals developed more rapidly than when the sows received barley alone, and the cost of the feed per 1 lb. increase in live weight, was from $^3/_4$ to 1 d. less when barley only was supplied.

CONCLUSION. — Provided the composition of the pig meal and pig compo is always the same as that of the products now prepared by the Metropolitan Abattoir Board, the following daily rations may be recommended.

1) *For Sows on Average Litters.* — 6 ½ lb. of crushed barley + 1 ½ lb. of pig meal, or pig compo. The daily allowance of barley should be increased each week by about 1 ½ lb. until weaning time.

For Young Growing Pigs:

Live Weight	Barley	Pig Meal
50 lb.	2 lb.	$^1/_2$ lb.
60 »	2 »	$^5/_8$
70 »	3 »	$^5/_8$ »
80 »	4 »	$^5/_8$ »

1260 – Experiments in Hogging Off on a Mixture of Maize and Soya in Indiana (United States). — WILEY, I. R., in *The Breeders' Gazette*, Vol. LXXIX, No. 22-2062. Chicago, June 1921.

Experiments carried out at the end of 1920, on 20 farms in Indiana. The work was done in close collaboration with the Purdue Extension Department. The total number of pigs used was 1524: the results obtained are given in the following Table.

		Averages	Minima and maxima		
Duration of the «hogging-off» period	*days*	45	21	to	87
No. of pigs kept per farm	*kg.*	76	27	»	182
Initial live-weight	»	45.99	21	»	79.65
Final live-weight	»	77.45	37.14	»	115.80
Increase in weight per day and per head	»	0.70	0.33	»	1.32
Amount of maize consumed during hogging off period	»	176	0.59	»	3.33
Yield of maize per hectare	»	3372	15.68	»	47.05
Increase in weight of pigs per hectare of forage crop	»	596.66	385.41	»	846.89
Increase of weight of pigs per 100 kg of maize consumed	»	17.72	11.57	»	28.58
Cash return per quintal of maize consumed	*dollars*	3.53	2.30	»	5.67
Amount of shelled maize required to produce 100 kg increase in live-weight	*kg.*	403.67	248.65	»	613.68
Cost of food required to produce 100 kg. increase in weight	*dollars*	8.27	5.14	»	13.61

The great variations in the increase in live weight and the amount of forage consumed may be attributed chiefly to the following causes: the difference in the weight and vigour of the animals when they were turned out; differences in treatment before turning out; the method of treating the pigs during hogging off.

Thus 60 young pigs which weighed on an average 24.04 kg. when turned out, consumed 586 kg. of maize for 100 kg. of increased live-weight. At the current price of 1.58 dollars per quintal of maize, the production cost of 100 kg. increase in live-weight amounted to 9.24 dollars. On the other hand, an increase of 100 kg. of live-weight can be obtained at the low cost of $5.74 if 37 young, strong, rapidly growing pigs with an average initial weight of 51.26 kg. are turned out to feed for 26 days. Their average weight at the end of this time will be 82.1 kg., which means an increase of 1.18 kg. per head and per day.

A good way of preparing pigs for hogging off on a mixture of maize and soya is suggested by SHRADER, Union Company, Indiana. The litters are farrowed between the last week of March and the middle of April. The sows are fed on ears of green maize (milky consistency) and a mash of ground oats and wheat meal. The piglets which remain with the sows until 10 weeks old are given hulled maize from the 5th week. Later a mash of wheat meal is added to the maize. After weaning, the young pigs receive ground oats and barley, as well as a mash of wheat flour and a limited amount of green maize cobs.

This ration (2.5 kg. of food per 100 kg. of live weight) together with a liberal supply of clover and plenty of water and shelter produces strong quickly-growing pigs in good condition and reduces the cost of the live-weight gains during the maize and soya period.

This period lasted from September 1 to October 23 on the different farms. The cheapest live-weight gains were obtained when the pigs could feed on maize-grain which was nearly ripe and had lost its milky consistency, and on soya which was still to a large extent green, though the pods were beginning to turn yellow.

The soya is eaten more readily and gives higher returns when the beans are not yet ripe. Thus the maize and soya crop should ripen at the same time.

Experiments have proved that in the northern third of Indiana, the soya varieties ripening with the maize are Ito San and Early Brown, and Hollybrook in the centre and south of the State.

In order to prevent the digestive troubles that may result from putting the pigs suddenly on a diet of fresh maize, it is customary to give the animals 1 to 2 cobs a day at first, and then gradually to increase the number till the maize forms a full ration.

1261 - **Wild Manihot as a Pig Food in Brazil.** — LOPES G., in *Secretaria da Agricultura, Commercio e Obras publicas do Estado de São Paulo, Boletim de Agricultura*, Series 22, Nos. 1 and 2, pp. 16-17. São Paulo, January-February, 192[illegible].

The roots of the wild manihot (or Manioc), contain a white, milky juice which is very poisonous when fresh, on account of the presence of hydrocyanic acid. This acid can however be very quickly removed by fermentation, boiling or drying in the sun, and roots thus treated may be fed to stock without risk. They can also be given fresh, especially to pigs, provided that neither the cortex, nor the adherent soil is removed, for the cortex and soil act as antidotes to the poison.

If animals have swallowed fresh manihot juice, they should at once be dosed with whey or a solution of sugar-cane molasses.

D^r^ LANNA, of the Thank-Ba Agricultural Station, has used salt, wine, and ipecacuanha successfully in the case of ruminants. Capsicums soaked in rum are given to human beings suffering from manihot poisoning.

1262 – **Scheme to Improve the Utility Value of Poultry Stock, in England.** — *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 7, pp. 583-584. London, Oct. 1921.

With the object of providing small holders, etc. with stock of good quality at reasonable prices, and thus of improving the utility value of the poultry stock, the Ministry of Agriculture has instituted a scheme for the distribution of sittings of eggs and day-old chicks. The number of eggs distributed in 1921 was over 104 000, being a slight decrease on the figures for 1920 (118 000), but an increase of nearly 100 % over those for 1919 (53 000). The number of day-old chicks distributed was nearly 38 000, an increase of about 17 000 over the previous year and 35 000 above the figures for 1919.

The total number of stations engaged in the work of distribution is now 256, compared with 172 in 1920 and 163 in 1919. The number of ducks' eggs distributed was nearly 1500. A beginning was made with the distribution of ducklings, over 200 being distributed by 28 stations.

The scheme is administered by local authorities.

1263 – **Capons Versus Cockerels for the Market in the United States.** — WAITE, R. H., in *The Maryland State College of Agriculture, Agricultural Experiment Station, Bulletin* No. 235, pp. 119-131, 9 figs., 2 tables, bibliography of 17 works. College Park, M. D., March 1920.

With a view to obtaining definite figures showing the relative size and rate of growth of capons and cockerels, the author carried out experiments in 1919, at the Maryland Agricultural Experiment Station. Forty-two White Plymouth Rock cockerels, all hatched on March 28 in the same incubator, were divided into two groups as nearly equal as possible, as regards health and vigour. On May 30, one of the groups was caponised. The two groups were kept entirely separate, and their gain in weight and the food they consumed were recorded.

Until October 1, both groups had access to poultry yards measuring 15 ft. × 125 ft. and after that date, they were confined to open-front houses 15 ft. × 15 ft. in size.

Until January 16, the following dry mash was fed to both groups *ad libitum*: bran 100 lb. — wheat middlings 100 lb. — beef scrap

30 lb. — bone meal 5 lb. — salt 1 lb. A mixture of white maize and wheat was also given as a scratch feed. From January 17, the following fattening ration was fed: Maize meal 100 lb. — wheat middlings 50 lb. — beef scrap 20 lb. — lucerne meal 30 lb. — salt 1 lb. — and in addition, wheat and yellow maize were given twice daily.

From May 28, 1919 to February 7, 1920, the average feed eaten (mash + grain), by the capons and cockerels respectively was 63.28 lb. and 62.00 lb. and the gains made were 6.66 lb. and 5.66 lb.

It was found that during the second period (January 17 to February 7), a less amount of food was required. The author suggests that this may probably be due to the vitamines which are said to be present in lucerne. Another possible explanation may be found in the higher vitamine content of yellow maize as compared with that of the white varieties (1).

A table giving the money gain or loss shows that at the present market price (average for period May 28, 1919 to February 7, 1920 : 4.02 dollars for capon weighing on an average 7.76 lb.), it does not pay to grow these birds if yarded and all the feed purchased, for present prices only just cover the cost of rearing. A fair profit can, however, be reasonably expected, if they are reared on a farm where they can range at will and pick up a fair proportion of their food, the balance of the ration being made up by grain of inferior quality, and feed. In dressing, capons lost 6 % of their weight. The live cockerels lost about 2.6 % of their weight during transport.

1264 - **The Effect of Electric Lighting and Climate on Egg Production' in Canada.** — HERNER, M. C., in *The Agricultural Gazette of Canada*, Vol. VIII, No. 4, pp. 446-448. Ottawa. July-Aug. 1921.

In the report on the Poultry Husbandry Department of the Manitoba Agricultural College (Canada), a description is given of the work carried out by the "poultry plant" branch. In addition to other work still in progress, experiments have been made concerning: 1) the effect of electric lighting on egg laying; 2) the effect of climate on the annual egg production.

I. — EXPERIMENTS ON EFFECT OF ELECTRIC LIGHTING ON EGG LAYING (2). — These experiments extended over 3 winters with White Leghorns and Barred Rocks. The results obtained clearly show that the use of electric light possesses certain distinct advantages for winter laying; the use is limited to the months of October to December, but the birds whose quarters are lighted lay many more eggs for which higher prices are paid, and the total revenue for the year is far superior to that expected from birds not subjected to light.

II. — EFFECT OF CLIMATE ON EGG PRODUCTION. — Experiments made in co-operation with the Poultry Department of the North Carolina Agricultural College at West Raleigh (U. S.). In August 1919, 25 White Leghorn pullets belonging to a heavy laying strain were sent to

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(1) See *R.* June 1920, No. 616. (*Ed*)

(2) See *R.* Feb. 919, No. 231. (*Ed.*)

West Raleigh; 25 pullets of the same age were reserved for the Manitoba Service. Both pens were fed exactly alike; the climate was the only difference. The appended Table shows the number of eggs obtained each month of the year beginning November 1, 1919 and ending November 1,1920.

The difference in favour of the North Carolina climate was 633 eggs or an average of 25.3 eggs per hen more than Manitoba. The observations made during this experiment encourage the hope that it will lead to quite an elaborate system of co-operative experimental work between the poultry departments of the different agricultural colleges and result in much closer co-operation than has existed hitherto.

Egg production for each month of the year.

Months		Manitoba	North Carolina
November	1919	232	150
December	1919	91	209
January	1920	131	115
February	»	205	207
March	»	366	357
April	»	315	435
May	»	309	462
June	»	320	331
July	»	155	383
August	»	212	309
September	»	77	110
October	»	4	13
	Totals	**2 537**	**3 170**

1265 - **Variation in Fecundity of Domestic Fowls in Relation to the Number of Oocytes in the Ovary.** — See No 1243 of this *Review*.

1266 - **Silk Producing Insects of the Republic of San Salvador: *Eutachyptera psidii* and *Rothschildia jorullo*.** - - CALDERON S., in *Revista de Agricultura Tropical, Organo de la Dirección General de Agricultura e Industria de la República de El Salvador*, Vol I, No. 1, pp. 9-11 figs 4. San Salvador, January 1921.

Among the various silk-producing insects in the Republic of San Salvador, the author mentions the Lasiocampid, *Eutachyptera psidii* Salle, and the Attacid, *Rothschildia jorullo* Westw., as capable of attaining a certain economic importance.

Eutachyptera (Metanastria) psidii lives wild in the oak-woods of the hills surrounding Ciudad Barrios, Department of San Miguel. The species is eminently gregarious, making large nests of white silk that house the colony.

In the "patio de ensayos" (experiment court), of the Agricultural Control Department the author fed the insects on the leaves of the guava (*Psidium Guayava*).

W. Schans, of the United States National Museum, informed Calderon that he has often seen them living in a natural condition on guava plants in the temperate zone of Mexico. The author has also fed the larvae, as soon as they were hatched out, on close-headed cabbage; he was able to accustom them after a time to guava leaves. When the cocoons have been perforated, the bags of silk can be carded. Each female insect lays 250 eggs, and from 23-27 days after oviposition the larvae emerge; they are about 7 mm. long, and cast their skins several times. The species is univoltine.

Rothschildia jorullo makes open cocoons that shine like silver. In his breeding experiments, the author was unable to obtain a single moth, for all the chrysalids were attacked by a parasite called "mosca negra" (*Belvosia analis* Macq.).

1267 - The Influence of the Incubation Temperature Upon the Retention of the Bivoltine Character (1). — Mollo A. (Istituto bacologico della R. Scuola Superiore di Agricoltura di Portici), in *Informazioni seriche*, Year VIII, No. 17, pp. 257-259. Rome, September 5, 1921.

It is well-known that bivoltinism is a very variable characteristic. The bivoltine breeds of silkworms of the Far East, on being introduced into Europe, tend to become univoltine, and the univoltine breeds that have been imported into Madagascar have become polyvoltine.

Toyama (On Certain Characteristics of the Silkworm which are Apparently Non-Mendelian, in *Biologisches Centralblatt*, Vol. XXXII, No. 10) states that voltinism is easily affected by temperature during the embryonic stage. From silkworm eggs exposed to about 80° F. (about 26.6° C.), moths were obtained all of which laid univoltine eggs, whereas if the eggs were kept at about 65° F. (about 18.3° C.) the moths laid either bivoltine or univoltine eggs.

The author, having experimentally tested Toyama's statements, found them to be correct in the main; bivoltinism is retained by incubation at 18° C; it is less certain that this character is lost by raising the incubation temperature to 25° C., for probably other factors also come into play. With an incubation temperature of 18° C. the number of bivoltine caterpillars was 96.9 %, but only 41 % when the temperature was as high as 25° C.

Moths laying non-bivoltine eggs in the rearings from eggs incubated at 25° C., were those that emerged latest from the cocoon. It has also been ascertained that bivoltine eggs become coloured 2 or 3 days only before hatching, while those that have lost the bivoltine character assume a violet-grey hue 3 days earlier.

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(1) See *R*. Oct. 1917, No. 936; *R*. Nov 1917, No. 1050; *R*. Jan. 1918, No. 75; *R* Feb 1918, Nos. 197 and 198; *R* May 1919, No. 627; *R*. July-Aug 1920, No. 786. (*Ed*)

1268 – **Practical Synopsis of the Different Breeds of Dogs.** — ZWAENEPOEL H., in *Annales de Médecine vétérinaire*, Year 56, No. 6, pp. 264-267. Ixelles-Brussels, June 1921.

The author makes a preliminary division into: I. breeds with normal proportions; II elongated breeds; III. thickset breeds; IV. breeds of the basset type; V. other breeds. The first 4 groups are subdivided according to: *a*) height; *b*) shape of muzzle and fang development: *c*) ears, eye, coat, tail. Such are the characters distinguishing the breeds as given in the annexed table (see page 1605–1608)

FARM ENGINEERING.

1269 – **The Water-Raising Machines and Motor Engines Most Suitable For Land-Drainage Plants.** — CARBONARO D. (Civil Engineer), in *Giornale del Genio Civile*, I. Year LVIII, pp 237-261, figs. 16 Rome, May 31, 1920; II. Year LIX, pp. 409-439, figs. 21. pp 469-496, figs. 22 to 31, July 31 and August 31, 1921.

In his first article, the author refers to the methods which he considers the best to adopt in choosing water-raising engines for land-drainage plants. In the second, he describes the motor-engines used for drainage purposes and the requirements they must satisfy. The examination of each of these engines is preceded by an explanation of the mechanical principles upon which its construction and mode of working are based. He also gives a short description of the types of engines suitable for draining land. This summary contains much practical information and should be a useful handbook both for students and engineers.

I. — The best water-extracting engines for land-drainage plants are those in which the chief water-raising part operates with a free rotary movement in the water.

In such machines the fixed and moveable components are extremely simple and can extract large quantities of water at reduced speed, and hence with regular and steady motion. To this class belong: *a*) water wheels with buckets; *b*) water wheels with float boards; *c*) water-raising turbines and centrifugal pumps. The latter will be in future the water-raising machines *par excellence* for drainage plants.

The author describes in detail the special conditions under which water extracting machines have to work: 1) the constant removal of turbid water, and especially of aquatic plants — 2) the great variation in the depth of the water between the periods of the highest level and those towards the end of the process; 3) the destruction of the metallic parts by the corrosive action of turbid water. Some means of preventing this trouble are suggested.

The author is of opinion, that the machines giving the best results in raising water during drainage operations are water-extracting turbines and centrifugal pumps with vertical axis, next coming centrifugal pumps with horizontal axis.

The latter, usually provided with a siphon, are suitable for low powers (not above 150, and preferably 100 HP.), for fairly clear water, and changes of level not exceeding 4 m. In such conditions, their defects

Practical Synopsis of the Different Breeds of Dogs.

I Breeds with normal proportions.	*A*. Tall	1. Square muzzle flews, well-developed; legs thick.	Ears long and lying close to head; face more or less wrinkled; eye blood-shot (exposing a corner of the mucous membrane of the lower eyelid); appearance powerful; coat short and wiry; tail slender and carried upright.	**St Hubert Dog** and its direct descendant, the *bloodhound*. **Large coursing Dogs**; *Foxhounds, Staghounds, Otterhounds, French, German, Swiss* etc *Greyhounds*.
		2 Blunt muzzle, flews little developed.	Ears average, drooping; face not wrinkled; appearance hardy; coat short and thick; tail usually cropped.	**Draught Dogs.**
	B. Of good height	1. Square muzzle, flews moderately developed.	*a*) Ears long and lying close to head; face normal; handsome appearance	**Shooting Dogs.** Short-haired: *Brachs* and *Pointers*. Long-haired: *Spaniels* and *Setters*. Wire-haired: *Griffons*. Woolly-haired: *Barbets* and *Water Spaniels*.
		2. Pointed muzzle without flews, lips close fitting.	*b*) Ears semi-drooping, face normal (1).	**Retrieving Dogs.** *Retrievers, Irish Water Spaniel, Chesapeake Bay dog.*
			a) Ears erect.	**Dalmatian Hound** (*). **Esquimaux, Greenland, Siberian** or **Laika, Kamchatka** dogs etc. with tail curled over back **Belgian Sheepdogs** with short, long, or wiry coat.
			b) Ears erect or turned over at tip.	**German Sheep Dog** or **Alsatian** Wolf-dog. **Herd-dog** (*) stronger in appearance than the sheep-dog. (Bouvier de Rouless, de Menin (**)
			c) Ears semi-drooping.	**French Sheep dogs** (Beauce and Brie). **Scotch Sheep dog** or **Collie** **Dobermann Pinscher** (**). **Rottweiler.** **Airedale terrier.**

(1) One asterisk signifies that the ears are sometimes cropped; double asterisk that cropping the ears is customary on the continent (the practice is forbidden in England).

Practical Synopsis of the Different breeds of Dogs (see also next page).

		d) Ears drooping.	**English** or **Bob-tail Sheep dog.** **Russian sheep-dog.**
C. Ordinary height	1. Square muzzle	Ears drooping, wrinkled face, stunted form, smooth hair, diminutive of Fox-hound.	**Beagle**: small coursing dog.
	2. Pointed muzzle.	*a*) Ears erect, tail curled over back, diminutive of Esquimaux dog.	**Chow-Chow.** **Spitz** or **Pomeranian.** **Samoyede.**
		b) Ears semi-drooping, diminutive of Airedale terrier.	**Welsh terrier.**
		c) Ears drooping.	**Bedlington terrier.**
D. Small size	1. Muzzle intermediate.	Ears drooping body rather slender.	**Harrier.**
	2. Pointed muzzle.	*a*) Ears erect, cropped tail.	**Louvain spitz.** **Schipperke.**
		b) Ears semi-drooping.	**Stable Griffon** (**). **Black-and-Tan terrier** (*). **White terrier** (*). **Fox-terrier.** **Irish-terrier.** **Kerry-terrier.** **Border-terrier.**
E. Dwarf	1. Normal head with pointed muzzle.	*a*) Diminutive of Spitz.	**Zwergspitz** **Seidenspitz** } Toy Pomeranian.
		b) Diminutive of water-spaniel.	**Lion-dog.**
		c) Diminutive of wolf-dog.	**Chihuahua.**
		d) Diminutive of spaniel.	**Maltese dog.** **Butterfly dog.**
		e) Diminutive of terrier.	**Toy black and tan terrier.**
	2. Head round and muzzle short.	Griffon coat, hair short or long.	**Affenpinscher** (**). **Brussels Griffon** (**). **Brabançon.** **Dwarf Japanese Spaniel.**

Intermediate forms: **Bull terrier**, derived from the White terrier (normal proportions) and the Bulldog (stunted proportions).
Boston-terrier ** of same origin as preceding.
Whippet, derived from the fox-terrier (normal proportions) and the greyhound (slender).

Practical Synopsis of the Different breeds of Dogs (see also next page)

II. Slender Breeds: body of greyhound type, long slender legs narrow head.	*A.* Large	Pointed muzzle	*a)* Ears erect.	**Balnéares** or **Charnigue Grey hound.** **Portuguese** or **Podengo Grey hound.** **Greek Grey hounds,** etc.
			b) Ears semi-drooping.	**Sloughi.** **Grey hound.** **Deerhound.** **Irish Wolfhound.** **Kangaroo-hound.** **American Long-dog.** **Barzoi.**
	B. Small.	Pointed muzzle	Diminutive of Sloughi.	**Italian Greyhound.**

Intermediate forms: the **Whippet** (see preceding group).
the **Ulm** (*) or **German watch-dog,** intermediate between the Greyhound and the Bulldog (thick-set type).

III. Breeds that are thickset with strong jaws and fore parts.	*A.* Large	1. Drooping ears of moderate size; absence of prognathism in lower jaw.	*a)* Very large, rather tall	**Pyrenees dog.**
			b) Very large, nearer the ground.	**St-Bernard dog, Leonberg, Durrenbach dog.**
			c) Very large, thickset.	**Thibet Watch dog.**
			d) Average size, thickset.	**Newfoundland dog.**
		2. Ears erect for ¼ to ⅓ of their length, moderate prognathism.	*a)* Average flews, moderate wrinkles, straight legs.	**Mastiff.**
	B Average size		*b)* Drooping flews, very deep wrinkles, straight legs.	**Bordeaux Watch dog.**
		Ears semi-drooping with prognathism	*a)* Average prognathism, straight legs.	**Boxer,** or **German bulldog.**
			b) Very pronounced prognathism, forelegs crooked.	**Bulldog.**

Practical Synopsis of the Different breeds of Dogs (concluded).

	C. Small	1 Bat-eared.	Derived from Bull-dog.	**French Bull-dog.**
		2. Ears semi-drooping.	Diminutive of Mastiff with tail curled over back.	**Carlin**, or **Pug**, or **Mops.**

Intermediate forms: **Bull-terrier, Boston terrier** and **Ulm Watch dog** (see preceding groups).

IV. Breeds with basset proportions (long body and short legs).	*A*. Average weight.	1. Straight legs.	*a*) Type of coursing dog	**Artois Basset.**
			b) Type of retrieving spaniel.	**Spaniels** Clumber, Springer, Field, Cocker etc.
			c) Terrier type.	**Scotch terrier.** **West Highland terrier.** **Sealyham terrier.** **Skye terrier.** **Cairn terrier.**
		2 Bandy legs.	*a*) Hair smooth	**Dachshund,** or **Teckel.**
			b) Hair wiry.	**Dandie Dinmont.**
	B. Light weight	1 Legs straight, or slightly bandy.	*a*) Round cat's head, close-lying Spaniel ears.	**Pekinese** and its English derivatives: **King. Charles, Blenheim** etc
			b) Terrier head	**Yorkshire terrier** (*).

V. other breeds: **hairless dog, edible dogs, fur** dogs **wandering** dogs, **wild dogs.**

in working are of little importance, and are set off by their greater simplicity, low cost of installation and easy means of upkeep. In the case of water containing much sediment, in which the differences in level are above 4 m., the HP. required to work the pumps would be very high and the cost excessive.

For very small plants (20 to 25 HP.) where it is wished to lessen the work of supervision as the force is limited, turbines succeed the best, for they reduce the cost of supervision and do not need any starting up. This conclusion might appear to warrant a return to the old water-raising apparatus, in which after water-wheels had been given up, the work had to be done at first by means of submerged turbines with a yield never exceeding 65 %.

It might also be objected, that the continual submersion of the turbines gives rise to high maintenance expenses; that it is not easy to keep the axis perfectly vertical in buildings subjected to the vibration of the machines and erected in alluvial soil in the process of hardening, that the use of check sluices in the discharge canal necessitates costly masonry work; that the check sluices often do not shut closely enough to prevent the introduction of marsh plants or detritus, a defect which may also be due to the sinking of the masonry, etc. These objections however disappear if we consider that: 1) the modern construction of water-raising turbines, thanks chiefly to the introduction of the diffuser, has increased the return to a figure equal to that obtained with the best centrifugal pumps (70 to 80 %); 2) in addition to the great advantages just mentioned, the supposed up-keep difficulties can be turned into means of real economy, if the plant is well studied and the work perfectly executed, so as to avoid the necessity for repairing the submerged parts, valves and the adjustment of the shaft, as well as any danger of the masonry subsiding: the work of supervision would by this means be greatly lightened; 3) the installation expenses are not greater than in the case of vertical pumps and in large plants they might even be less than for horizontal centrifugal pumps.

In future, the use of turbines or vertical centrifugal pumps is likely to become general, for excellent results have been obtained with them in large drainage plants; in this connection it will suffice to mention the extensive drainage operations at Codigoro (Province of Ferrara) the refitting-docks of Venice and Taranto, and the great draining works carried out by the ESCHER WYSS Firm of Zurich.

Finally, the author describes the HUMPHREY and "Stereophagus" pumps. These are based on principles differing entirely from those determining the construction of the apparatus previously examined, and being suitable for large water surfaces and small differences of level, it is probable that they could be used for drainage. CARBONARO concludes by giving a list of the manufacturers of the best and most generally used drainage pumps.

II. — As hydraulic motors (which are difficult to use at the lowest levels of the land to be drained), must be excluded, the motors that can be used in water-raising plants are of 3 types: steam, internal combustion and electric. The author gives a detailed study of these types, and in such order, that each machine described is more suitable for drainage purposes than the one previously mentioned.

Steam Engines. — According to the author, boilers with small water pipes should not be used: the apparatus is complicated, costly and entails heavy installation and maintenance expenses for which the advantage of rapid evaporation does not compensate. Further, this advantage can also be obtained, to the required extent, by using boilers with large water pipes of the 3 types: 1) the Cornish boiler with one or more furnaces; 2) boilers with smoke or flame, pipes; 3) boilers with large water-pipes: the author considers the last and the Cornish boiler the best.

In boilers with smoke pipes the ends of the pipes exposed to the flames wear out more rapidly, and are practically never used for fixed plants, in which the essential quality of these boilers viz., their lightness, is of no advantage.

Cornish boilers, being rapidly freed from incrustation, are especially suited for hard waters if filtering-beds are not to be used. In other cases, boilers with large water-pipes are preferable, because in land drainage work the essential object to be attained is great power of evaporation combined with maximum of security in the case of an explosion. It is always well to use economisers and superheaters.

As regards the motor, the best are: for pressure up to 6-8 HP., monocylindrical engines, for 6-10 HP., double expansion engines, for 10-15 HP., triple expansion engines, for over 15 HP., quadruple expansion engines. For forces above 100 HP. condensation is necessary.

For low speeds, up to a maximum of 100 revolutions per minute, which are much used in drainage operations, distribution by release should be employed, above this limit (in drainage, as many as 200-225 revolutions per minute can be reached), as a rule, distribution by valves is used.

Steam turbines have great advantages over piston engines: a thermic return of 40-60 %, as against 22-30 % per second; total return 95 %, or over, as against 90 %; weight for equal strength ¼, much lower coal consumption etc. They have however not as yet been employed in drainage plants, on account of their great speed, necessitating the use of reducers, either because the return decreases perceptibly with variations in the charge, or because, contemporaneously with the invention and improvement of turbines, DIESEL and electric motors were invented and soon brought to a perfection that made them justly preferred for drainage plants.

Internal Combustion Engines. — The author examines gas engines, liquid fuel engines, DIESEL engines, semi-DIESEL or semi internal combustion engines, and gives, as in the case of the boilers and steam engines, a list of the best-known manufacturing firms.

Electric Engines. — These, whether with constant, or alternating current, or with induction, can all (with the exception of synchronous engines with alternating current), be used in drainage. For speeds of over 150-225 revolutions per minute, reducers causing an average loss of energy of 3 to 5 % are necessary; they are not required for low speed engines, but the latter are dearer. For this reason, especially for low pressure (up to 100 HP.), high power engines are almost always preferred. On each occasion the choice can be regulated by obtaining a specification.

In the case of high pressures, the machines are directly coupled to an electric motor with vertical axis which must be carefully chosen to meet particular requirements.

As regards the type, the output of engines with continuous current is lower than that of the FERRARIS alternating rotatory. They cost more to keep in order, and cannot be used for high powers (above 500 volts), owing entirely to the friction which destroys the brushes of the collectors (these have to be renewed every 2 years), and to sparking. Further, these FERRARIS engines use the least economical form of current, the continuous, which, in long distance transmission would cause great loss of energy.

These advantages, and the almost universal employment of alternating currents in the Central Electric Station, have led to the use of rotatory engines. Of the latter, three phase types are chosen, as the monophase type, owing to the presence of brushes and collectors which are in continuous use during work, have the same defects as engines with continuous current. These troubles are further aggravated by the alternating character of the current; the brushes have to be renewed every 2 months, and the collector every 3 to 4 years; this entails an expense amounting to 15 % of the cost of the engine, and the interruption of the work for 1 to 2 months, often necessitating the keeping of a reserve engine.

On the other hand, the three phase engine combines the following advantages, it is cheaper at the same pressure; its structure is simpler, for it uses the three phase current without any previous transformation; it is stronger, and the spirals are more easily detached; it requires no collectors or brushes, (those needed for starting remaining unused during working; it can stand a constant speed and strong and abrupt over-charges (30 % for several hours, 50 % for half-an-hour and even 100 % for some minutes).

The adoption of three phase currents has made it possible for the force to be transmitted a long distance without any considerable loss; the invention of the rotatory permits the direct use of the force without the necessity of further transformation. These two applications mark the greatest progress hitherto made in industrial electricity.

It now remains to consider the advantages electric engines have over heat engines, and amongst the latter, the DIESEL, which deserves absolute precedence over all the others.

The installation advantages are evident: the low price of the DIESEL which costs, including millwrighting and accessories, 500 to 200 *lire* per HP (pre-War price), for both small and large engines, whereas electric engines with alternating or continuous current, and counting reducers, transformers, accessories, tables, etc., do not as a rule, cost half that amount except for the cable.

The cost of the cable cannot be estimated; it depends upon the distance separating the plant from the Central Electric Power Station or place of current distribution, but in most cases, all cable expenses devolve wholly or in part upon the Station supplying the force and, on the other hand, as the cable can serve for the transmission of the current to several plants, the expense can be divided among the various users.

With electric engines it is possible to divide up the surface to be drained into small areas with separate plants and with differences of levels less marked than is necessary with a single installation. This question, however, requires careful study in each case, and does not admit of a general *a priori* solution, though it is possible to foresee the great economy which might thus be effected:— in hydraulic operations, fewer agricultural canals, collectors and over-flow channels, fewer cuttings and shallower excavations, a reduction, even of several years, in the time needed for draining; less force absorbed by the water raising engines, less time expended in constructional work (small electropumps in a corresponding number of small sheds require less solid foundations and often a total masonry cubage below that of a large Central Station), etc. So much as regards installation.

The advantages as regards maintenance are very plain. Electric motors and transformers are of quite simple construction; break downs which are frequent in the case of the DIESEL are always of rare occurrence, so that the maintenance expenses are hardly ever half of those involved where the DIESEL is used.

Finally as regards actual working, a distinction must be drawn between:

1) Supervision expenses: these are less in the case of electric engines than with the DIESEL, as the former can be handled without any difficulty; one man can superintend several neighbouring plants, and if they are not very large, can set them in motion from a distance. This applies especially to automatic low-power engines with no brushes, or collector. In some cases (as in the drainage of the "dongepolders" in Holland), the engines can be started automatically by means of floats and electric relay substations.

2) The consumption of lubricants: electric engines always need less lubricants than any others, because friction occurs only in the supports, and in the speed reducers, if present.

3) In electric motors, replacements of the lubricant and rags alone are necessary, whereas a constant supply of fuel is required with DIESEL and steam engines.

4) The starting: this is absolutely instantaneous in electric engines, no pumps or compressors etc. being used, as in the case of the DIESEL, and involving a certain loss of power.

5) The cost per HP. hour: this in DIESEL engines is about 3 *centimes* (average oil consumption per HP. hour 0.20 kg. which at 0.10 fr. the kg., makes 0.02 fr., and with the lubricator and losses, about 0.03 fr.), or 3 *centimes* per kilowatt hour (pre-War prices). In order that the electric

engine may show a similar result, the kilowatt-hour must not cost above 3.5-4 *centimes*. A considerably higher cost (3 to 6 *centimes* and over), can however be allowed, owing to the compensation due to the advantages above-mentioned, especially in large plants working only a few months annually.

In any case, the electric Power Stations make different charges according to working hours, the lowest being at night and in the morning when there is less demand for power for other services. If the work of the plant is limited as far as possible to the hours of the night and morning, and if the cost of current is diminished by the construction of large hydroelectric plants, it may fairly be anticipated that electric engines will soon possess all the qualifications necessary to their extended use in land-drainage operations.

In all cases where fuel can be procured on the spot, and its use is advisable from the standpoint of economy, it is certainly desirable to build a central Power Station and work the water-raising apparatus with electric engines.

When used in groups of several units, wind engines can render signal service in assisting the elevators where the current supplied is of weak, or average strength and can serve as trustworthy auxiliaries of heat or electric engines.

The author concludes by giving detailed information on the subject of water-raising plants already at work, or in course of construction, in Italy and other countries.

1270 – **Construction and Use of Evaporators in California.** — See No. 1274 of this *Review*.

RURAL ECONOMICS

1271 – **The Farms in Quebec, Canada, Their Yields and Methods of Administration.** — STE MARIE J. A. (of the Cattle Breeding Service of the Federal Ministry of Agriculture, Ottawa), in *Dominion of Canada Department of Agriculture, Experimental Farms Bulletin* No. 96, 14 pp. Ottawa, 1920.

A preliminary enquiry into the condition of Agriculture in six counties in the province of Quebec for the year ended March 31, 1920.

In each county a representative district has been selected, and in each district a survey has been made of 25 representative farms.

Special forms have been used for the collection of the information required, and by this means it has been found possible to construct an inventory, approximately complete and accurate for each farm.

The receipts from various sources were analysed and their total gives the *gross revenue for the farm*.

Expenditure was classified under a number of headings and the total gives the *gross expenditure*.

The work of the farmers' sons, aged 14 years and upwards, is reckoned as of equivalent value to that of the manual labour employed, so that, as regards the *labour income* all can be treated on the same basis.

TABLE I. — *Size of farms and labour income.*

Size		*acres* 41-60	*acres* 61-80	*acres* 81-100	*acres* 101-120	*acres* 121-140	*acres* 141-160	*acres* 161-200	*acres* 201 more
Number of farms		15	17	37	11	14	9	21	25
Average size	*Acres*	50	74	95	113	132	153	187	311
Average tillable area	»	44	71	84	97	119	125	152	249
Average crop acres	»	47	71	89	102	120	140	161	252
Average total capital	*Dollars*	4 408	12 673	16 881	16 867	20 091	16 595	25 232	41 657
Average capital in Real Estate	»	5 199	8 017	11 640	11 614	13 765	11 306	18 370	32 521
Average per cent capital in Real Estate	%	55	63	69.0	68.8	68.5	68.1	72.8	78.1
Average capital in Buildings	*Dollars*	1 640	1 576	1 657	1 700	2 257	1 889	1 871	2 600
Average per cent capital in Buildings	%	17	12	9.8	10.1	11.2	11.4	7.4	6.2
Average capital in Machinery	*Dollars*	967	1 171	1 173	1 264	1 229	964	1 355	1 716
Average per cent capital in Machinery	%	12	9	6.9	7.5	6.1	5.8	5.3	4.1
Average capital in Live Stock	*Dollars*	1 602	1 909	2 411	2 289	2 841	2 436	636	4 820
Average per cent capital in Live Stock	%	17	15	14.3	13.6	14.2	14.7	14.5	11.6
Average Crop acres per man	*Acres*	39	41	48	54	62	59	66	78
Average Crop acres per horse	»	21	28	33	36	38	45	39	54
Average Animal Unit	*A. U.*	12.9	16.7	19.2	20.2	23.9	23.1	30.2	42.3
Average Live Stock Index	*No*	100.1	96.5	96.1	88.2	104.2	100.1	102.2	101.2
Average Crop Index	»	133.1	110.0	113.8	116.9	102.4	81.7	105.8	81.7
Average Crop sold	*Dollars*	99	221	409	449	349	325	827	971
Average Stock sold	»	155	315	307	2.4	302	324	419	411
Average Butter, Cheese or Milk return		600	653	760	835	1 167	1,022	1 630	1 908
Average Swine sold	»	176	167	241	237	310	356	227	634
Average Sheep or Wool sold	»	16	23	43	22	11	12	71	83
Average Poultry sold	»	37	108	19	17	19	23	20	36
Average total Revenue	»	1 083	1 487	1 779	1 784	2 159	2 062	4 195	4 043
Average Labour	»	109	287	252	244	415	404	499	1 216
Average Feed bought	»	128	71	116	84	312	233	225	387
Average Current Expenses	»	120	33	164	175	198	177	214	356
Average depreciation on Buildings, Machinery, Live Stock	»	339	387	438	440	513	433	593	777
Average Interest on capital	»	564	760	1 013	1 012	1 205	995	1 513	2 499
Average Labour income	»	— 177	— 151	— 204	— 171	— 485	— 180	+ 149	— 1 192
Average Labour income for best 5 farms	»	+ 155	+ 830	+ 1 285	+ 326	+ 384	+ 278	+ 2 273	+ 556
Average Labour income for poorest 5 farms	»	— 418	— 819	— 1 467	— 664	— 1 279	— 545	— 1 149	— 3 403

Depreciation is reckoned at 10 % per annum for machinery and live-stock, and 5 % for farm buildings.

Interest on the total capital is reckoned at 6 %. The balance after deducting the total of expenditure from the total of receipts is called the *labour income*, being in fact the salary of the farmer and his wife in return for management and actual labour.

As, in the farms to which the Enquiry relates, there were several groups, making no labour income the term « *plus labour income* » or *surplus* is used in cases, where receipts are in excess of expenditure to indicate the salary of the farmer and his wife. The term « *minus labour income* » is used in cases where the year's working gives an adverse balance with a deficit in place of a surplus.

Definition of terms. — An *animal unit* is a horse or cow. Young cattle or other classes of live-stock are portions of the unit, greater or less according to the amount of food consumed. The following number is required in each case to make up an animal unit: one or two year old heifers, 2 — calves, 4 — full-grown hogs, 4 — sheep, 7 — fowls, 100. Thus a farm may be said to have 24.5 animal units with a total stock of 3 horses, 12 cows, 1 bull, 8 heifers, 4 calves, 5 pigs, 14 sheep and 50 fowls or their equivalents.

Cash Crop: term commonly employed for all crops sold direct for ready money.

Crop index: the value of all the crops raised on all the farms to which the enquiry relates is totalled and divided by the total number of acres under cultivation. The result gives the basis of comparison and is represented by the number 100. Thus a harvesting index of 120 shows that the value of the acres cultivated on the farm in question is 20 % higher than the average of the farms included in the survey.

A *live-stock index* of 105.5 shows that this particular farm makes a profit on its animal units 5.5 per cent above, while a farm with a *live-stock index* of 78 makes a profit 22 % below the average.

The *tillable area* is the number of cultivated or cultivable acres on the farm.

Crop acres is the number of acres giving crops or pasture.

The terms " five best " and " five worst " farms indicate respectively the farms where the labour income is highest and lowest without qualification or reference to quality of soil or live-stock or amount of capital.

The first table indicates the size of the farms surveyed and the labour income. The conclusions derived from these figures are quite at variance with those resulting from similar surveys made elsewhere in so far as the labour income instead of increasing with the size of the farms and in proportion to their size, shows irregular variations in different groups of farms. For this result two particular groups are mainly responsible.

In the district of l'Assomption, as a result of the system of cultivation practised, the labour income has been generally higher than elsewhere; in the district of Lake S^t John, on account of the high land values, the average working profit is reduced to nil. Thus each time that the farms of these districts are in the majority in a set of returns, the results are modified materially: otherwise they would have been very similar to those obtained from other enquiries of a similar character.

A comparative table of the 5 best and 5 worst farms for each district is given.

The results obtained by the 5 best and the 5 worst farms in the l'Assomption district show that the difference in labour income does not arise from a difference in capital expenditure, signifying poor quality of soil or live-stock, any more than in a difference in the average size of the farm or average

TABLE II. — *Cultivation specialised or general.*

		Dairy Farming plus a Cash Crop	General Dairy Farms	Dairy Farming for City Trade
Number of farms	No.	25	25	25
Average total capital	$	20 610	16 319	19 402
Average size of farms (crop acres) . .	Ac.	141	113	129
Average Animal Unit.	AU	24	22.1	26.4
Average Live Stock index	No.	103.5	100.2	116.5
Average Crop index	No.	125.8	108.5	108.3
Average per cent Gross Return	%	14.4	12.2	13
Average Return per Animal unit . . .	$	81.2	75.2	87
Average Return of Cash Crop per acre	$	7.86	2.87	1.74
Average per cent cost of total expenditure	%	12.9	12.6	13.4
Average Labour Income	$	+ 320	— 60	— 70

of the total expenditure. It depends rather upon the very important factor of good management, which is expressed by an average gross return of 23.9 % on capital for the 5 best farms as against a gross return of 9.3 % for the five worst farms. This difference in gross return in favour of the 5 best farms is to be explained by the fact that these farms make 103 *dollars* per animal unit, while the 5 worst farms make 67 *dollars* only. Moreover the 5 best farms make in cash crop profit 14.90 *dollars* an acre, while the same source gives a profit of 2.67 *dollars* only for the poorest farms.

This difference of 14.6 % in the gross return in favour of the 5 best farms gives a labour income of 2 396 *dollars* to the more successful farmers, while the 5 worst farms show a deficit of 708 *dollars*. As these two groups of farms both belong to the same district, work in similar climatic conditions and on similar soil, and are of similar dimensions and similarly capitalized, one is driven to the conclusion that the 5 worst farms do not know how to turn to best account their natural advantages. Other figures also lead to the same conclusion : notably the relative proportion for live stock (live stock index), which stands at 146.2, the relative proportion for crop returns (crop index) which stands at 176 in the case of the 5 best, while for the 5 worst the figures do not exceed 90.6 and 86 respectively. These points deserve the fullest consideration for they are responsible for the remarkable difference in labour income shown by the two groups.

All the groups or districts in which the farms do not make a profit are those in which the live stock index falls below 100.

The survey has proved that the working of a farm costs on the average 13 % of the total capital invested. Hence, unless the various farming operations are so arranged as to obtain a return from the different sources of revenue in excess of 13 %, the farm will show a net loss.

In order to ascertain what branch of farm work contributes most largely towards labour income the author made a study of three groups, each consisting of 25 farms in the three districts showing greatest similarity. A certain number of farms from each district were included in each of the three groups (See Table II).

The first group — dairy farms + a cash crop — includes farms which sell their milk in the form of cheese or butter and in which 70 % of the crops sold consists of fruit, grass and clover seeds, potatoes, maple sugar, tobacco and vegetables, not marketed through the live stock.

The second group — general dairy farms — includes farms which sell their milk through the cheese factory or creamery and in which 70 % of the crops sold consists of hay and grain.

The 3rd group — dairy farms for city trade — includes farms producing and selling their milk for city trade; their cash crop is comparable with that in one or other of the two earlier groups.

An examination of Table II shows that one group only (dairy farms plus cash crop) makes a working profit, while the two remaining groups show a slight deficit.

The average size of the farms varies slightly in each group, but as the amount of capital per *acre* is almost constant throughout, the difference in average size cannot be considered the determining factor, for the results in groups 2 and 3 are almost identical. Similarly the percentage of total cost although somewhat higher in the case of the 3rd group than in the others cannot be regarded as the sole determining factor, for group 2, in which it is lowest, makes no labour income. One can only conclude that group 1 makes on an average a higher labour income by obtaining a gross average return which is 1.4 and 2.2 % higher than that obtained by group 2 and group 3. This is to be accounted for by the fairly satisfactory return give en by its animal units coupled with the return for cash crop which is higher than for the remaining groups.

The farms in group 3, — dairy farms for city trade, — have a larger head of cattle, chiefly cows, than the farms in the two first groups, and these animals are of better quality as is shown by the live stock index figure and the return per animal-unit. However in spite of the high quality of the cattle, the percentage of gross revenue does not reach the average percentage of the total expenditure and labour income shows a deficit. This is due to the fact that the farms in this group pay little attention to the subsidiary lines of work, such as cash crops and the rearing of hogs and sheep. It is to be concluded that specialization in milk-production for town trade is not the most remunerative branch of farm work.

The farms in group 2 — general dairy farms — may be regarded as of intermediate type. The cattle in these farms are of inferior quality as is shown both by the live stock index and the receipts per animal unit. At the same time, as the sale of hay is the chief cash crop, fewer cattle are kept, fewer hands employed, there is less expenditure on cake and thus working expenses are on a lower scale. Hence, while the gross revenue of these farms falls below that of the other groups, the net results are practically the same as those of group 3 though they are inferior to those of group 1, the only group which shows really successful working.

The examination of the three types of farm makes it clear that in order to reckon on obtaining a working profit, the average gross return must be at least equal to 14 % of the total capital employed on a farm.

Many speakers and writers have urged the importance of employing sires of pure strain and high quality for all classes of cattle, if these are to give satisfactory returns. With the object of ascertaining the exact value of a good sire, the author divides all the dairy herds covered by the survey into three groups as follows: group 1 includes the herds in which a few or all the cows are of pure stock as also the sire; group 2 includes grade and high-grade cows served by a pedigree bull; group 3 cows and bull of common type The results are given in Table III.

TABLE III. — *Quality of the bull, production per cow and labour income.*

District	No. of farms	Pure bred and High grade cows headed by pure bred sire	Average Milk Revenue per Cow	Average Labour Income	High grade cows headed by pure bred sire	Average Milk revenue per cow	Average Labour Income	Common cows and sire	Average milk Revenue per cow	Average Labour Income
		average No.	$	$	average No.	$	$	average No.	$	$
L'Assumption	25	25.0	108	+1 746	12.8	97	+1 248	12.0	85	+ 91
Lachute.	25	16.2	126	+ 28	12.3	134	— 136	14.3	110	— 884
Aubrey	23	10.9	108	+ 39	9.0	87	+ 313	8.8	70	— 269
Bedford.	22	15.0	90	—1 011	18.8	67	— 630	16.5	67	— 119
Montmagny	24	10.4	82	— 388	7.5	61	— 336	9.1	63	— 542
St Gedeon (Lake St. Jean)	26	16.0	66	—1 127	21.3	65	—1 931	11.5	51	— 1 384
Average of total.	24.2	15.0	101	— 110	14.0	89	— 321	12.0	72	— 487

None of these groups shows a working profit. The quality of the cows is not the sole factor contributing to this result, although the loss on working tends to increase almost in the same ratio as the quality of the cows deteriorates. It will be seen that group I, composed of pure bred or high grade cows shows an average yield of 101 dollars per head. In group 2, in which the cows are half-bred or high grade with a pedigree bull, the average yield is 89 dollars, and in group 3 (common type of cow and bull), 72 dollars only per head. Thus in the average yield per cow, there is a difference of 12 dollars as between groups 1 and 2, and of 29 dollars, between groups 1 and 3.

As on the average the herds in group 3 consist of twelve cows, the average annual difference in return is 348 dollars as between groups 1 and 3, *i. e.* in favour of the cattle of pure stock when compared with the common type served by a bull of similar class without taking into account the results in the future generations. At least 65% of the milking herds in the province (which, in 1919 numbered 756 512 cows) are served by a bull of common breed.

General conclusions. — 1) A farmer who aims at making a plus labour income must so work his holding as to obtain a gross receipt above 13 % of the total capital invested and keep his working expenses below this figure.

2) In order to obtain a return in excess of the 13 % of capital in the prevailing conditions, each livestock unit on the farm must show an average return of 90 dollars or over, and to this must be added the receipt from a cash crop return, that is the sale of field crops

3) To secure an average return of 90 dollars or more per live-stock unit, the stock must be of good breed liberally fed and well tended.

4) the cash crops sold to increase the gross return should be of such a kind as not to cause any marked reduction in the number of live-stock units maintained.

5) Farms which make a plus labour income are those in which the live stock index and the crop index is 100 or over.

6) Farms with a high live-stock index use invariably sires of pure breed and good quality.

7) Farms with a live stock index of 100 or over generally return a plus labour income index.

9) Farms with a crop index of 100 or over and a live stock index below 100 always show a deficit.

9) The size of the holding is not the sole factor making for success or otherwise in farming.

10) General dairy-farming and dairy-farming for city-trade do not give such satisfactory returns as dairy-farming combined with a cash crop.

11) The yield from cows varies with the quality of the bull employed. Bulls of common breed or low quality cause in the province of Quebec an annual net loss of over 11 million dollars.

AGRICULTURAL INDUSTRIES

1272 - **Wine Making in Peru.** — See No 1230 of this *Review.*

1273 - **Fermentation of Electrified Distillery Musts.** — MEZZADROLI G. (Sotto-Direttore della R. Stazione Sperimentale della Coltura della Barbabietola, Rovigo), in *Bollettino dell'Associazione Italiana delle Industrie dello zucchero e dell'alcool,* Vol. XIV, No. 6, pp. 120-121. Bologna, Sept. 1921.

In one of the large distilleries of South Italy, the must used was electrified for a fairly long period (about 20 days).

The cellar was fitted with iron vats connected by several charge-pipes which enabled the electric current to be transmitted from one vat to another. The contact was made by means of the conducting wires carrying the light to the lower part of the cellar; in this way, the receptacle and the must flowing into the iron vats were electrified, only some of the vats being left untouched.

The author was unable to measure the amount of electric force supplied to the vats and musts; some idea of its strength could however be obtained from the fact, that if a person dipped his finger into the fermenting liquid, or into the must flowing into the vats, the electric shock was more than he could stand.

Microscopic and chemical examination revealed no alteration in the fermentation process, or deterioration of the ferment in the electrified vats as compared with the unelectrified barrels.

A very large number of investigators have made experiments with a view to determining the action of electricity upon fermentation, but it is rare to find an experiment carried out on such a large scale as that just described (where 900 hectolitres of must were treated daily) and continued for a sufficiently long period.

The microscope showed: a quite clear, pure alcoholic ferment free from all foreign microorganisms, the cells being turgid and transparent, neither granular nor corroded at the edges. The fermentation was such as takes place in the presence of a high acid content. The multiplication of the microorganisms was slightly reduced, but not to the point of endangering the progress of fermentation; the author therefore saw no necessity to lower the density, and increase the oligozymogenetic salts, in order to obtain a larger quantity of yeast, and hence greater enzymic activity.

From the chemical point of view it was noticeable that towards the end of fermentation, less acid was formed as might be expected in the absence of foreign microorganisms and especially of butyric bacteria. No special determination was made of the quantity and quality of the products obtained from these electrified musts, for the laboratory possessed the means for a superficial test only. The alcohol was also quite satisfactory in rectification plants.

The substances fermented were fig-juice followed by carob-juice; both were fairly clear, having been first filtered.

The author mentions this case, for, if the experiment were repeated at another distillery, it would be desirable to test the effect of the electricity and also have some means of measuring the amount of electrical energy applied to the must, in order to know whether the process could be profitably adopted as an easy and convenient means of obtaining pure fermented liquids.

1274 - Grape-drying: Construction and Working of Evaporators in California (1).

— CRUESS, W. V., CHRISTIE, A. W., and FLOSSFEDER, F. C. H., in *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* No. 322 pp. 421-471, figs. 11, Tables 8, Berkeley, Ca., 1920, and in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. X, No. 2, pp. 60-66. Sacramento, Ca., February 1921.

I and II. — Evaporators of many types have been used with varying degrees of success for many years. From the experience gained in the use of these evaporators and from observations and measurements taken by scientific investigators certain principles have become recognised. Lately however, some of the older theories are being discarded or seriously modified. Most of the data here reported were obtained in the commercial evaporator at the University Farm, Davis, California, although a great many small scale experiments were made in the experimental evaporators at Berkeley.

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(1) See *R*. Dec. 1918, No. 1101; *R*. August 1921, No. 858; *R*. September 1921 No. 953. (*Ed*)

An evaporator of the horizontal tunnel air-blast type and of 6 tons of fresh fruit capacity per charge, was constructed during 1919 on the first mentioned farm by funds furnished by the State Board of Viticultural Commissioners and the University. This was used successfully in the drying of grapes and prunes. Plans, cost and general specifications of this evaporator are to be found included in this article. Sketches indicating revised evaporator plans recommended to growers are also given.

Most of the suggested improvements are now being made on the farm evaporator described. The revised plan is given, and the general specifications of an effective type of improved emergency evaporator are shown as follows: —

1. *Tunnel.* — Inside dimensions, 50 × 6 ½ feet wide × 7 feet high. Walls of double thickness with building paper between the walls. T. & G flooring on 2 × 4 inches pine frame.

Air return flue 50 × 6 ½ × 2½ feet of same construction as tunnel to be placed above the tunnel. This to connect to fan discharge and to furnace room. An additional height has been found necessary for efficient operation and rapid drying. Floor of tunnel to be of concrete or of coarse sand and to be 18 in. higher at fan end than at furnace end of the tunnel. A sliding door on one side, one foot from each end of tunnel, 7 ft. high × 64 in. wide. Doors to be hung on overhead track and rollers.

A 24 in. dry yard track of 8 pound per yard rails on 4 × 4 in. ties, 2 ft. on centre, imbedded in the floor. Track to extend between transfer tracks making it 37 ft. in length.

Transfer tracks with rails 42 in., apart to extend through each door connecting at end of tunnel to the tunnel track and to shed track at side of tunnel track (See figure). All wood parts at end of tunnel connecting to furnace room to be covered with double thickness asbestos.

Connection to furnace room to be full size of tunnel.

2. *Furnace Room.* — Six-inch reinforced concrete or hollow tile construction recommended. If a cheaper, but still safe type of construction is desired, use corrugated sheet metal over a frame of 2 in. iron pipe. Do not use wooden framework. Floor of gravel. Room 16 ft. long × 11 ft. high × 8 ft. wide, inside dimensions.

Install furnace and heating pipes before erecting furnace room.

Furnace to consists of an old boiler shell 10-12 ft. long × 36 – 48 in. in diameter (48 preferred), with tubes removed and one head removed. Other head to connect horizontally to 12 in. pipe. All rivet holes or other openings to be sealed smoke tight. Open end of furnace to project through end wall of furnace room opposite tunnel and to be fitted with a motor-driven crude oil or distillate burner if electric power is available;

otherwise with a gravity distillate burner of largest size. Furnace also to have a removable grate, which may consist of several cross bars and 8 or 10 lengths of dry yard rail. This is useful in emergencies to permit burning of wood or brush. An adjustable door 2 ft. × 3 ft. is installed above the furnace in end wall for admission of fresh air.

Heating pipes of 12 in. heavy gauge black sheet iron: 9 pieces 12 feet long arranged above the boiler in three tiers. Pipes to be supported on 1 in. water pipe framework. Heating pipes joined at ends by return bends, except at furnace outlet and stack, where 2 way connections are used. Two 2 way connections: one short piece pipe about 1 ft. long; 7 return bends and 5 elbows will be needed.

3. *Fan.* — Multivane fan with top vertical discharge. Fan wheel of 42 inches diameter and to operate at 450 R. P. M. or greater speed. To be located at end of tunnel opposite furnace room and to be used as a suction fan. The fan outlet to connect to air return flue and to an open air discharge of same cross section as fan outlets. Both outlets to be fitted with adjustable dampers so that any desired proportion of the air may be recirculated. A 20 h. p. motor or engine is necessary for power.

It is assumed that a tractor or some means of power used for other purposes will be used to operate the fan. This fan will cost over $500. It may be replaced by a 7 foot disc fan to operate at 400 R. P. M. This is much cheaper but is less satisfactory.

4. *Cars.* — Twenty Fresno County style dry yard cars with wooden frame. Frames 3 ft. × 6 ½ ft. long and to be placed at right angles to the track upon which the cars operate. Two uprights of 2 in. × 4 in. pine to act as tray guides in centre.

Cars to be fitted with bumpers to permit clearance of wheels.

Two lower steel transfer cars for 42 inch track.

The tunnel cars should have strips of rubber matting nailed to bottom of frames to prevent passage of air below the cars.

5. *Trays.* — The cars designed for 2 ft. × 3 ft. raisin trays with 1 in. × 2 in. cleats at ends. When stacked on the car there will be an open space of 2 inches between trays.

6. *Shed.* — Shed 60 ft. long × 20 ft. wide, to cover drying tunnel and to provide protection for unloading dried fruit. Shed may be of "lean to" design and should be at least 7 ½ ft. high at eaves.

7. *Modifications necessary for 8-Foot Trays.* — The tunnel must be made 8 ft. 3 in. wide for 8 ft. trays. The cars must have frames 8 ft. × 3 ft. No other changes necessary. The trays to be stacked crosswise of the tunnel.

When the trays are stacked on the cars it will be necessary to place strips at least 1 ½ inches high between them to permit passage of air.

8. *Modifications necessary for 6 × 3 Foot Trays.* — No centre guide posts will be needed on the cars for these trays. This is the only change necessary. It will be found advisable to place high cleats across ends and centres of trays to permit passage of air.

9. *How Plant May be Cheapened.* — The tunnel walls may be made of heavy roofing paper double thickness. The furnace room may be made of corrugated metal. A disc fan made to order for $100 or less may be used, but this will reduce the efficiency of the plant. The shed over the drier may be covered with roofing paper. It is strongly recommended that the furnace room, drying tunnel and air return flue be built in the proportions indicated and that no reductions be made in the size of the fan or the air heating system.

USE OF THE EVAPORATOR. — It is assumed that the evaporator is only to be used in unfavourable drying weather. Therefore no provision has been made for sulphuring houses, dipping equipment, etc.

1. *Stacking Trays.* — In case of rain it is still necessary to stack the trays in order that the fruit may be as little damaged as possible before it reaches the drier. The evaporator is able to deal with a limited amount of fruit only at each loading.

2. *Sulphuring Wet Fruit.* — In cases where a very large proportion of the fruit is still on trays and where the fruit is severely wet with rain it is advisable to sulphur all of such fruit which the drier can not attend to for 3 or 4 days. This will check mould and fermentation. Sulphur hoods such as those described by BIOLETTI and WAY (1) may be quickly made of light wooden frames and roofing or building paper. These are placed over the stacks of trays. Raisins are sulphured 30 minutes, and prunes 1 to 2 hours.

3. *Loading the Cars.* — Muscat field trays with side cleats and with ends open would be stacked crosswise of tunnel on the cars and with 1 ½ inch strips between them to permit passage of air.

Trays 6 ft. × 3 ft. and 8 ft. × 3 ft. would be stacked crosswise of tunnel on the cars, and 1 ½ inch strips placed between them.

4. *Heating the Fruit.* — After the tunnel is filled, the burner is started. About 15 minutes later the fan may be started. Until the fruit is thoroughly heated and the air at the furnace end of the tunnel reaches 160° F., the fan is allowed to discharge into the return flue and all of the air is recirculated. The preliminary heating will usually require about an hour.

5. *Continuous Operation.* — After the fruit is heated the fan should then be adjusted so that about three-fourths of the air is recirculated and one-fourth allowed to escape.

The temperature should not rise above 165° F., although 160° F. may be used safely.

It will be found difficult to determine when the fruit is sufficiently dry. This is best done by removing a small sample of the fruit from trays at the furnace end of the tunnel and allowing it to cool for 15 or 20 minutes. Its degree of dryness can then be determined fairly accurately. There is a tendency for most operators to over-dry the fruit.

6. *Air Baffles.* — Should there be a tendency for the trays near the top of the tunnel to dry more rapidly than those nearer the floor, sheet

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(1) *Circular* 211, *Univ. California.* " Saving Raisins by Sulphuring ", 1919. (*Ed.*)

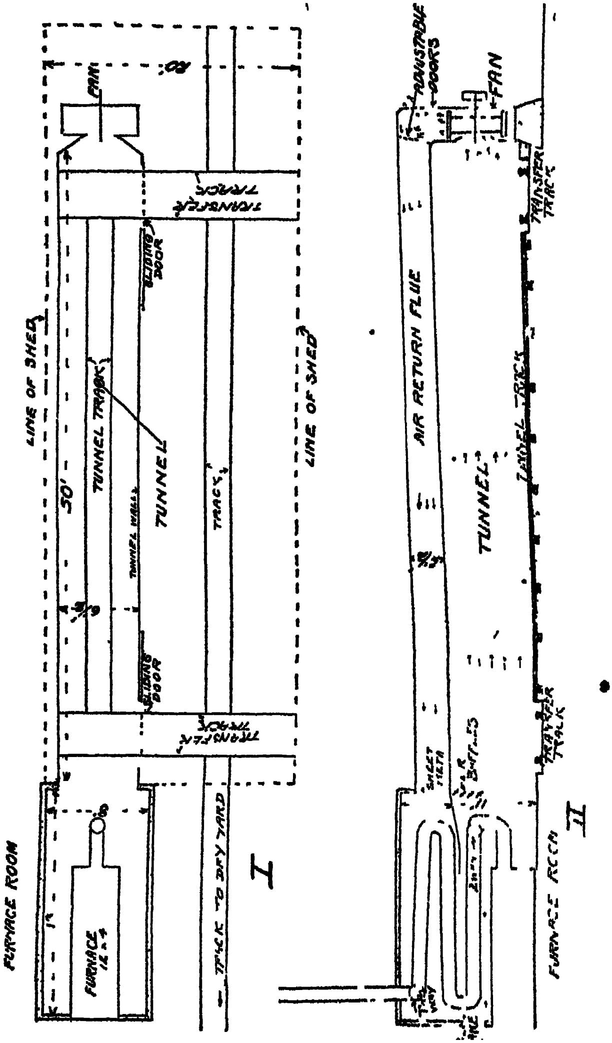


Fig. 1. — *Ten ton capacity Emergency Evaporator.*

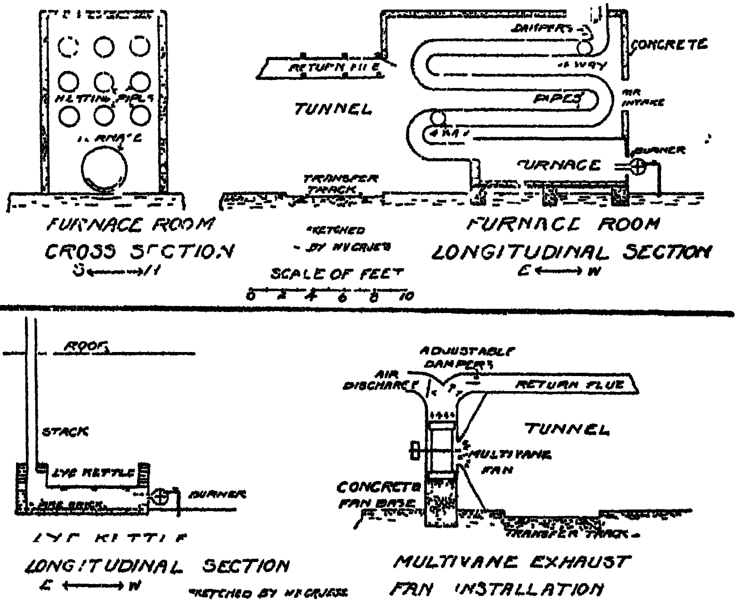
Plan of Evaporator.

Longitudinal section of Evaporator.

metal adjustable baffles may be placed across the opening between the tunnel and the furnace room. The upper half of the opening may be covered in this way and the baffles adjusted at an angle which gives even distribution of the air.

Air tends to flow between the stacks of trays and the walls of the tunnel, and above the topmost tray and beneath the trucks more rapidly than it does between the trays. Should such air leakages be evident it will

Fig. 2. — *Revised University Farm Evaporator.*



II.

be necessary to nail flexible baffles to the walls and ceiling to force the air between the trays. Rubber door matting or second-hand rubber belting may be used. Such baffles are usually necessary and their use must not be neglected if efficient drying is desired.

Dipping the grapes in a dilute boiling lye solution approximately doubled the rate of drying. Most wine-grape varieties and Muscat grapes required a lye solution of 2 to 3 % to obtain successful results. Tokays and Thompson's Seedless required only a ½ % solution.

The suction type of fan proved more satisfactory than the blast type. The multivane fan was found to be much more efficient than the disc type. The air-blast distillate burner was more satisfactory than the gravity burner, although both were used successfully. An air blast progressive tunnel type of evaporator with furnace equipped to burn oil or wood, and with cars and trucks to facilitate handling of the trays, is recommended. A small stack evaporator is recommended for smaller farms: —

General Specifications of Small Stack Evaporator: — 1) Four drying compartments each 10 ft. long × 7 ft. high × 37 in. wide, above a fire pit. Compartments open above pit and to ventilator.

2) Each compartment equipped with 15 horizontal tray runways of 2 in. × 2 in. material; runway 10 ft. long and nailed to 2 in. × 4 in. studding.

3) Partitions between compartments open, except for tray runways.

4) One folding door, 7 ft. × 38 in., for each compartment.

5) Outer walls of dryer of 1 in. × 12 in. material surface one side, double, with 3 in. sawdust-filled space between.

6) Roof of lean-to construction, lower side at height of top of drying compartments, higher side about 4 feet above top of compartments.

7) Ventilator, 12 ft. × 2 ft. and 6 ft. high above centre of roof.

8) Fire pit 14 ft. long × 10 ft. wide, 4 ft. below ground line, and 4 ft. above. Walls of 6 in. concrete. Several 1 ft. × 1 ft. openings at ground line for admission of air. Would be better if air were admitted at bottom of pit instead of at ground line.

9) Furnace of old boiler shell 6 ft. long and 3 ft. in diameter. Bottom lined with fire brick. Excavation and steps leading from ground level to furnace floor level.

10) Burner, large stove distillate type. Fed from tank above by gravity.

11) Air heating pipes: One 16 in. pipe connecting to furnace at one end of chamber and to 20 in. drum at other end. This 20 in. drum in turn connects two 9 in. pipes which return to the furnace end of room. At the furnace end of room these two pipes connect by vertical elbows to two 9 in. pipes which return to opposite end of pit. They are here joined by a T joint to a 9 in. pipe returning above centre of pit to the smokestack. There is, in all, one 16 in. pipe about 6 ft. long; one 20 in. drum, about 8 ½ ft. long, and five lengths of 9 in. pipe, each about 13 ft. long. One end of each 9 in. pipe projects through the cement wall and is covered with a soot cap to facilitate cleaning.

12) Trays: Ordinary 8 ft. × 3 ft. dry yard trays are used but 2 ft. × 3 ft. field trays may be placed in the drier. In the compartments, tray No. 1 should be placed against the rear wall, No. 2 against the door, No. 3 against the rear wall, and so on for the other trays. This arrangement will force the air to flow across the trays.

It is necessary to shift the trays from the top of the compartments downward, one tray ar a time, as the lowermost tray becomes dry, for the reason that the fruit on the trays near the top of the compartment dries very much more slowly than that on trays nearer the furnace.

Recirculation of a large proportion of the exhaust air from the evaporator greatly reduces final consumption without reduction of the rate of drying. Recirculation prevents overdrying of the fruit and permits regulation of moisture content of the dried product. It is believed that higher temperatures of drying may be employed where the humidity of the air used in drying is increased by recirculation.

The rate of air flow through the evaporator, and especially over the trays, determines the rate of drying. An anemometer is used to measure the velocity of the air currents.

Dried grapes of 25 %, or less, moisture kept perfectly; those of 30 % or over were spoiled unless heavily sulphured. The dried product equalised rapidly in moisture content, and stemmed satisfactorily within a few hours of drying, when dried to about 10 % moisture. Flat-bottom trays were found to be distinctly preferable to screen trays for many reasons.

No definite constant difference in yield could be found between sun-drying and evaporation. The colour and flavour of the juice obtained by soaking sun-dried grapes in water, was much inferior to juice obtained from evaporated grapes. Temperatures up to 190° F. were used successfully on red wine grapes, although it was found necessary to remove them from the evaporator as soon as dry, to avoid injury to colour and flavour. A temperature of 165° F. may be used in regular practice.

1275 - **The Utilisation of the Stones of Table Fruit.** — TRUELLE A., in *La Nature*, No. 2467, pp. 19-20. Paris, July 16, 1921.

The stones of our principal table fruits are regarded as waste products of no account, whereas in certain cases they could be used profitably either as food or in the orchard, in the various ways described by the author.

RATIO OF STONE WEIGHT TO TOTAL FRUIT WEIGHT. — Our chief table fruits are, in order of ripening: cherries, apricots, peaches and plums The proportion the stone bears to the fruit is little known, but some idea of it can be gathered from the figures taken by TRUELLE from 1) *Recherches sur la composition des fruits frais* by AIMÉ GIRARD, published by LINDET in 1918, in the *Bulletin du Ministère de l'Agriculture* and; 2) from Dr. HOTTER'S papers *Die chemische Zusammensetzung steinischer Obstfrüchte* published in *Landw. chemische Landes-Versuchstation Graz*, in 1906.

The figures found by Aimé GERARD are as follows:

Weight of stones per 100 gm. of fresh fruit.

Cherry English	6.01 gm.
» Royal	8.60 »
» Montmorency	6.01 »
Apricot Auvergne	7.12 »
» Blanc de Paris	5.50 »
» De plein vent	6.40 »
Peach Midi	8.38 »
» Montreuil	5.20 »
» Perpignan.	6.19 »
Plum Reine Claude	4.07 »
» Monsieur	1.77 »
» Mirabelle	5.65 »

HOTTER states that the weight of the stones per 100 gm. of fully-developed fruits varies in cherries, from 4.4 gm. to 15 gm.; in apricots, from 6 to 11 gm.; in peaches, from 8.5 gm. to 13 gm.; in Reine-Claude plums, from 5.3 gm. to 9.1 gm.; in Mirabelles, from 4.7 gm. to 12 gm.

It is found that in Styria the variations in the proportion of the stones for the same kinds of fruits are even greater than in France. If certain natural variations are disregarded, the figures show that these fruits, as regards the proportion of the weight of stones to total weight, may be arranged in the following ascending order: plums, apricots, cherries, peaches

USE FOR TABLE. — With the stones the confectioner, and even the housewife, can make creams, distilled waters, essences, hippocras, ratafias and sherbet. As the special flavour characterising hippocras and ratafia is due to the hydrocyanic acid and oil of bitter almonds produced by the decomposition of the amygdaline present in the kernels, which takes place in the presence of water, the stones of peaches and cherries especially, must not be used to excess, as they contain much more of the acid than those of the other fruits.

HIPPOCRAS. — The ancient tonic drink known by this name was made with sweetened red wine in which cinnamon was infused. Fruit-kernel hippocras is a kind of ratafia made of white wine containing the fresh kernels of apricots, peaches, and occasionally of plums, but never of cherries. The following is a recipe for 5 litres of white wine:

Take 15 stones of the above-named fruits, crack without injuring the kernel, soak for 24 hours in 25 centilitres of brandy (alcoholic strength 50°) add 300 gm. of sugar dissolved in white wine, leave the mixture to stand for 48 hours: strain and filter through filtering-paper to obtain a clear liquid.

RATAFIA. — This can be made in two ways; with kernels only or with the entire stones. The first method is the better with apricots and peaches, and the second with cherries and plums. The following is a recipe for 1 litre of brandy (alcoholic strength 60°).

From 75 to 100 gm. of kernels should be taken, whatever stones are chosen, but three or four kinds may be used, provided the total weight does not exceed this amount. Thus 30 gm. of apricot, peach and plum kernels can be used, and 10 gm of cherry kernels. If peach and cherry kernels are used alone, it is better to keep to the minimum quantity of 75 gm.

Blanch the kernels in hot water, and put them into a bottle containing 1 litre of brandy (alcoholic strength 60°); cork, and leave to soak for 10 days. Then strain or filter through paper, adding to the liquid a clarified syrup made by heating 500 gm. of sugar with half a litre of water. If this produces slight turbidity, filter again to obtain a perfectly clear liquid. Keep in well-corked bottles in a room with average temperature.

USE FOR HORTICULTURE. - *Collecting the stones.* This must be done in such a way as to leave the integument intact and clean. When the stones of the four fruits are used industrially in large quantities for the preparation of essences, syrups or wines, care must be taken whatever means of extraction are used to see that all the kernels, which are not absolutely entire, are allowed to pass out of the press together with the refuse pulp. The best results are obtained with the different implements used by confectioners for the purpose.

PRESERVATION. — Fruit stones may be used in two ways: 1) sold to seed merchants; 2) sown for seed. In the first case, the stones are washed as soon as procured, and put to dry on a screen in a rather strong current of air or in the sun, but not in a drying stove, as the heat would affect their power of germination. They are then shut up in wooden or tin boxes in a dry, well-ventilated place, to prevent the growth of moulds, and the attacks of insects and rodents.

The author does not know the sale price of stones, which varies according to the kind of fruit, quantity, quality etc. The following prices taken from trade catalogues will however give a general idea: apricots 3 fr.; cherries 3 fr.; ordinary peaches 5 fr.; Montreuil peaches 10 fr.; plums 2.50 fr. to 4.50 fr. per kg.

When the stones are kept for sowing at the right season, the best way of preserving them is "stratification." This means placing the stones in layers alternating with beds of damp sand, or fine soil.

The beds then made are 3 to 5 cm. thick according to the size of the stones. The object of this method is not only to preserve the stones in good condition until they are planted, but also to prepare them for germination by softening the integument and thus encouraging the growth, and extrusion of the radicle.

In the country, horticulturists requiring a limited number of plants can put 20-30-40 stones in layers in a flower-pot, on any earthenware jar. When however it is desired to make a small nursery, a box should be used, or with a great number of seeds, a conical heap should be made in the open air the stones being arranged in layers on raised dry beds of soil, as already described.

It is best to arrange the stones in layers at once, and then protect them from the weather and rodents. The receptacle containing the stones may be placed in a cellar, or store-room where the temperature is low and regular, and covered with a tile or a sheet of glass, or if the heap is buried at the foot of a wall, a little mound of soil 0.40 m. high can be piled over it to protect the stones from frost and rain. With a large number of stones intended for sowing, the soil should be 0.50 m. deep and covered with a layer of straw 0.10 m. thick, the straw being kept in position at the top by an inverted flower-pot. A circular trench round the mound completes the arrangements. Under favourable conditions, germination begins in March, and when the temperature is suitable, the seeds can be planted in well-prepared soil from March-April.

1276 - **The Commercial Utilisation of Cotton Stalk.** — *Bulletin of the Imperial Institute*. Vol. XIX, No. 1, pp. 13-18. London, 1921.

The question of the most economical method of disposing of the enormous quantities of cotton stalks which are left after the crop has been harvested is one that has received much attention. The destruction of the stalks is particularly important if they are liable to harbour insect pests, which might otherwise be carried over from one season to the next. In most cotton growing countries it is usual to use the cotton stalks as fuel and their utilisation in any other direction would therefore depend on their local value for this purpose.

I. — SOURCE OF FIBRE. — Experiments have been made in the United States and in Egypt to test the possibilities of utilising cotton stalks as a source of fibre. Results appeared to indicate, however, that the extraction of fibre from the bark of the stalks would not prove a profitable undertaking, as the work involved in handling and retting the stalks and preparing the fibre would not be repaid by the price obtainable for the product. In this connection it may be roughly estimated that with a yield of 1000 lb. of stalks per acre, it would be necessary to collect and treat the stalks from 10 acres to obtain ½ ton of fibre, the value of which would be only about half that of Bengal jute.

II. — PAPER MAKING TRIALS. — Trials carried out by the United States did not give encouraging results; the pulp was found difficult to bleach on account of its dark outer bark, and the yield varied from 35 to 43 % with a short and weak fibre. Cotton stalks however under recent examination at the Imperial Institute and coming from the Punjab and Central Provinces in India proved more promising. Results showed that when treated by the caustic soda process these Indian cotton stalks yield a paper pulp of fair quality, which can be bleached to a pale cream tint. The yield of pulp is rather low (34 to 41 %) and it has been found necessary to employ larger quantities of caustic soda than in the case of esparto and similar grasses, but the results are sufficiently promising to justify further consideration.

III. — DISTILLATION TRIALS. — Preliminary trials have been carried out recently at the Imperial Institute with a view to determining the possibility of utilising cotton stalks for the production of charcoal, pyroligneous acid and other products, by the process of dry distillation. The stalks used came from the Central Provinces, India, and the results, expressed in percentages by weight on the stalks as received are shown as follows:—

Weight of material distilled, 3 lb.; Time required for distillation 3 hours; % Charcoal 35.4; crude pyroligneous acid 41.1 (containing: acetic acid 3.0, dissolved tar 2.6, crude wood napththa (100 %), 1.5); tar separate 7.6 (containing acetic acid, 0.4). Total yield of tar 10.2, total yield of acetic acid 3.4

The tar obtained was a fairly thin readily mobile liquid of brownish-black colour; the charcoal obtained could only be ranked as fuel charcoal; the acetic acid yield was rather below the average quantity obtained from hard-woods but the yield of wood naphtha was about normal.

The feasibility of distilling cotton stalks successfully in India would depend, on finding local markets for the products, especially the charcoal and tar. Regarding the cost of distillation, attention is drawn to the fact that as cotton stalks are bulky materials, they would require large retorts even if they were cut in pieces and compressed before treatment.

1277 - **Utilisation of West African Corkwood, *Musanga Smithii* for the Manufacture of Paper Pulp, etc.** — *Bulletin of the Imperial Institute*. Vol. XIX, No. 1, pp. 10-13. London, 1921.

Two logs of corkwood, *Musanga Smithii* R. Br., were sent recently from Sierra Leone to the Imperial Institute for examination.

The wood was found to be soft and easily worked, but possessing a short coarse grain. Owing to the exceptional lightness of the wood, experience has proved the unsuitability of using this material for the manufacture of artificial limbs, as originally suggested. However, as a source of paper pulp the wood appears to be a promising material. The wood required rather drastic treatment but gave a good yield of pulp which possessed satisfactory felting properties.

The wood treated with caustic soda resulted in a pulp which was in some cases difficult to bleach and in others bleached to a cream colour.

Wood treated by the sulphite process was found to yield 56.25 % of dry pulp as compared with 50 % by the caustic soda process, and the pulp although slightly darker in colour, bleached almost white. The papers made from the bleached and unbleached pulps obtained by the sulphite process were not quite so strong or as soft as those from pulps prepared by the soda process, but it should be possible by modification of the sulphite treatment to obtain pulp which will furnish a good white paper.

It is not likely that corkwood could be profitably exported from Sierra Leone as a source of paper pulp but if a pulp mill were established in the country, corkwood could be utilised for the manufacture of paper pulp for export.

1278 - **Studies in Milk Analysis.** — I. Mac Inernly, T. J., and Troy, H. C. A Comparative Study of Some Methods for Determining the Fat Content of Skim-Milk, in *Cornell University Agricultural Experiment Station, Bulletin* 401, pp. 69-85. Ithaca, New York, January 1920. — II. Machens A., and Cordes F. R., Un nouvel appareil pour la determination de la catalase dans le lait, in *Milchwirtschaftliche Zentralblatt*, p. 25. Hanover, February 1, 1921; *Le Lait*, Year I, No. 2, p. 84. Lyons, 1921.

I — A COMPARATIVE STUDY OF SOME METHODS FOR DETERMINING THE FAT CONTENT OF SKIM-MILK. — The accuracy of the Babcock test for determining the percentage of fat in skim-milk has been questioned for several years. On comparing the fat percentages obtained by this method with the percentages found by the Adams gravimetric method, it was found that the latter gave higher results. The slight modifications introduced into the technique of the test also caused the percentage of fat to vary, and it was clear that considerable losses of fat might occur without detection when the ordinary Babcock method was used. For these reasons, the authors decided to make a fresh study of the problem, and to make a comparative test of the following methods; Adams (Official and Provisional Methods of Analysis, *United States Bureau of Chemistry Bulletin* 107 [revised] 1908, p. 120); Roese Gottlieb (Report of the Committee on Editing Tentative and Official methods of Analysis, *Association of Official Agricultural Chemists*, 1916, p. 289); Mojonnier; Leffman-Blam modified (Henry Droop Richmond, *Dairy Chemistry*, 2nd Edit., pp. 221-228, 1914); Babcock.

The results of these experiments prove that the following modifications should be made in the Babcock test when it is used in determining the fat content of skim-milk.

1) At least 25 cm³ of sulphuric acid should be used. If the size of the bottle permits, as much as 28 cm³, can be used to advantage.

2) The temperature of the testing machine should be at least 82 C (180° F).

3) A *centrifuge* having a disk 15 inches (38 cm.) in diameter, and strong enough to be run at a minimum speed of 1 800 revolutions a minute without danger, is recommended. The diameter of the disk is determined by measuring the distance between the bases of the opposite cups when in a horizontal position.

4) The milk should be *centrifuged* for 10-2-1 instead of for 5-2-1 minute periods.

II. — NEW APPARATUS FOR DETERMINING THE CATALASE IN MILK. — MACHENS and CORDES have devised a new apparatus to take the place of FUNKE's apparatus which did not give very accurate results, and those invented by LOBECK, and by LOBECK and OTTOKER, which appear to be rather difficult to handle.

MACHENS and CORDES' apparatus is composed of two bottles; one (*A*) containing the milk and oxygenated water, the other (*B*) in communication with a graduated tube and serving as a gasometer. *A* and *B* communicate by means of a tube furnished with a tap having 3 outlets. The zero level at 37° C is determined in the gasometer at 37°, and the milk is put into flask *A* when the temperature has reached 37° C; flasks *A* and *B* are put into communication with the external air, the oxygenated water is added to tube *A*, and *A* and *B* connected. The change of level in the graduated tube allows the amount of oxygen liberated to be measured.

If the catalasimetric degree of the milk is very high, and too large a quantity of oxygen is liberated, *A* and *B* are isolated by a turn of the tap, the level is again readjusted in tube *B*, *A* and *B* are once more placed in communication, and the new level reached is added to the first.

1279 - **Studies on Variation in the Reaction of Freshly Drawn Milk.** — I. VAN SLYKE L. L., and BAKER, J. C., in *New York Agricultural Experiment Station, Geneva, N. Y., Technical Bulletin*, No. 70, pp. 1-9. Genoa, N. Y., June 1919. — II. BAKER, G. C., and BREED R. S. in *The Journal of Biological Chemistry*, Vol. XLIII, No. 1, pp. [illegible]. Baltimore, Md., 1920.

I. — CONDITIONS CAUSING VARIATION IN THE REACTION OF FRESHLY DRAWN MILK. — The most sensitive method of measuring the reaction of milk is by measurement of the hydrogen-ion concentration. This method has been employed by several investigators (FOA, 1905; VAN DAMM, 1908; ALLEMAN, 1912; TAYLOR, 1913; DAVIDSOHN, 1913; MILROY, 1914; CLARK, 1915, and it has also been utilised in the work here reported.

The results of the experiments made by earlier investigators showed that milk, when freshly drawn, has a reaction, expressed in terms of hydrogen-ion concentration (pH) varying from 6.39 to 6.81, the usual range being between 6.50 and 6.65.

The present authors propose to ascertain the extent of variation of reaction in large numbers of milks obtained directly from the cows and to discover, if possible, the cause of such differences. The following points are considered : 1) the extent of variation of reaction in cow's milk ; 2) variation in different quarters of the udder ; 3) relation of reaction of milk to composition ; 4) effect of abnormal conditions in the udder.

More than 300 samples of fresh milk were examined, and the reaction expressed in terms of pH values varied between 6.50 and 7.20 ; being under 6.76 in 80 % of all the samples.

In the case of 20 cows, it was found that the pH value of the milk from different quarters of the udder varied considerably, but in most cases the variations were negligible.

The pH value varies with the composition of the milk. In general with a decrease of acidity, there is a marked tendency towards a decrease in specific gravity, and in percentage of fat, total solids, solids minus fat, casein and lactose, but an increase in proteins other than casein and in ash and chlorine.

These changes in composition are such as would be expected if flood serum or lymph were added to normal milk. Similar abnormal conditions in the udder may cause such an addition.

Examination of abnormal milks of low acidity having a pH value above 6.80, indicates that the reaction, is accompanied by the presence of large numbers of leucocytes, though in such cases, the reaction may be neutralised by the presence of large numbers of acid producing streptococci. While the theory of the presence of blood serum or lymph in such milk is supported by several considerations, a careful test for glucose proved negative. It is concluded therefore that the glucose in the blood-serum must undergo a change in the udder.

II. — REACTION OF MILK IN RELATION TO THE PRESENCE OF BLOOD CELLS AND OF SPECIFIC BACTERIAL INFECTIONS OF THE UDDER. — BAKER and BREED have made observations concerning the leucocyte and streptococcus content of a number of samples of milk, with a view to the verification of the hypothesis put forward by VAN SLYKE and BAKER, who suggest that decreased acidity of fresh milk is due to the direct filtration of blood serum owing to lesions of the blood vessels or to bacterial action.

From the new data here collected by the authors, and from histological and physiological considerations, it appears that a more exact statement of the case would be that infection causes the entrance of a serous exudate derived by the gland cells directly from the lymph rather than from the blood. This serous exudate is neither similar exactly to blood serum nor to milk. When the infection has so advanced that actual rupture of the vessels occurs, then the unchanged lymph and blood enters. The modifications in the secretions may be due to a weakening of the secretory activity of the cells, or the exudate may have a definite protective function acting against the bacterial infection, or both conditions may hold good simultaneously.

The changes in the secretory processes seem to be accompanied by wastage from the glandular epithelium.

1280 – **A Method for the Preliminary Detection of Abnormal Milk Based on the Hydrogen Ion Concentration.** — BAKER, J. C., and VAN SLYKE, L. L. (Chemical Laboratory of the New York Agricultural Experiment Station, Geneva) in *The Journal, of Biological Chemistry*, Vol. XL, No. 2, pp. 357-371. Baltimore, M. D., Dec. 1919.

The method described by the authors is based upon the use of the dye, brom-cresol purple previously suggested by CLARK and LUBS as a substitute for litmus for use in milk cultures (1). A drop of a saturated water solution of the dye is added, and the colour is then observed. In the case of average milks of normal character, the colour becomes bluish-grey. If the colour is distinctly lighter or darker, there is ground for suspecting the quality of the milk. The colour ranges from a bright yellow at one extreme to a deep blue at the other. The colour is made lighter by the presence of acids, acid salts, formaldehyde solution, and also by heating above the usual point of pasteurisation. It becomes a deeper blue in the case of milk from diseased udders, watered milk, skimmed milk, and milk containing additions of alkali or an alkaline salt.

Attention is called to certain conditions which modify the characteristic colour given by brom-cresol purple solution with average normal milk. The presence of extra fat (5 % or more) gives an appreciably lighter colour than is the case with ordinary market milks containing 3 to 4 % of milk fat. Skimmed milk gives a darker colour than the same milk before the removal of fat. With milks drawn directly from the cows on fresh pasture, the colour is a decided yellow which modifies the colour reaction with brom-cresol purple.

The utility of this method has been demonstrated by the testing of 570 samples of market milk.

The authors emphasise the fact that the application of the brom-cresol purple test is not to be regarded as final but only as preliminary and suggestive. Milks giving a normal coloration will then be considered as normal; and a sample showing an abnormal coloration can be put aside and submitted to careful examination in the laboratory. The chief value of the brom-cresol purple test lies in the fact that when properly used, it will greatly minimise the work involved in official milk inspection.

1281 – **The Value of the Reductase Test in the Dairy Industry** (1). BARTHEL CHR. (Bacteriological Laboratory of the Central Station of Agricultural Experiments, Experimentalfaltet, Sweden), in *Le Lait*, Year I, No. 2, pp 62-66. Bibliography of 10 works. Lyons, 1921.

Among the methods of testing milk, the methylene blue reductase test has again become the subject of much discussion. Two main objections have been raised viz., 1) in the case of milk from isolated cows, discoloration sometimes takes place very rapidly, although the milk contains but an insignificant number of bacteria; 2) it is not a perfect method for determining the number of bacteria present in milk.

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(1) See *R.* Aug. 1918, No. 908. (*Ed.*)

(2) See *R.* 1913, No. 176. (*Ed.*)

The author in discussing these criticisms states, that as regards the first, a thorough examination has shown, that all milks which changed colour very rapidly (that is to say before 2 hours had elapsed); were abnormal. They had a high catalasimetric index, an abnormal number of leucocytes, or were the products of cows that were in the very last lactation period.

LIND (1) has made similar statements. As, however, in the dairy industry the reductase test is applied exclusively to mixed milk, the product of several cows, the first objection has no real weight. As regards the second, the author urges that the reductase test is purely practical. Further, if the results obtained by BREED or SKAR (2), by directly counting the bacteria under the microscope, are compared with BARTHEL and ORLA-JENSENN'S computation based on the length of the methylblue reaction (1), it will be found, that in about 90 % of the cases the estimated number of bacteria in the milk is identical. This is a fairly good proof of accuracy; moreover when the milk of different retail sellers has been subjected several times to this method of examination, the discrepancies have in practice proved to be negligible.

In the case of milk supply to towns and large dairies, the first *desideratum* is that the methods adopted should be practical and simple, so that a large number of samples can be examined at once, especially from the point of view of their keeping properties. Hitherto no method has for this purpose proved superior to the reductase test. In addition, this method could serve as a basis for payment according to quality, on the condition, that the price be fixed by the average number of marks accredited to each seller during a certain period of consignment. In this way, the small irregularities inseparable from the method are eliminated, and have no effect upon the final verdict.

1282 - **Carbonic Acid and Carbonates in Cow's Milk.** -- VAN SLYKE, L. L., and BAKER J. C., in *New York Agricultural Experiment Station, Geneva, N. Y., Technical Bulletin*, No. 66, p. 1-9. Geneva, N. Y., June 1919.

The amount of carbonic acid present in cow's milk has been the subject of several investigations (HOPPE, 1859; SETSCHENOW, 1861; PFLÜGER, 1869: THÖRNER, 1894; MARSHALL. 1902). The results obtained by thes investigators vary from 1.84 to 7.65 % of CO_2 by volume. The methods employed varied from extraction by means of a vacuum pump to expulsion by heat and have been more or less inexact. Consequently the authors have started fresh work on the subject on the following lines: 1) determination of CO_2 using VAN SLYKE'S method (*Journal of Biological Chemistry*, Vol. XXX, p. 347, 1917); 2) relation of pasteurised milk to CO_2 content;) the form in which CO_2 exists in milk; 4) the tension of CO_2 in milk.

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(1) LIND *Maelkeri Tidende* 1915, p. 291 and 1920, p. 207. (*Ed*)

(2) BARTHEL CH., Die Methoden zur Untersuchung von Milch und Molkereiproducten. Berlin, 3rd Ed., pp. 113-121

Milk is drawn from the udder into a 100 cc. cylinder, completely filled in such a way as to avoid mixture with air or loss of CO_2. For the determination of CO_2 2 cc. of milk were forced from the cylinder into the VAN SLYKE apparatus and a 20 % solution of lactic acid was added to free the CO_2 in carbonate form

In the case of 25 samples of milk drawn from each quarter of the udder, the CO_2 varied from 7 to 86 % by volume; the pH value varied generally with the CO_2 content (6.50 to 7.16). With increase of pH value the general tendency of the CO_2 is to increase while the degree of acidity as measured by titration decreases.

In comparison with other workers, higher CO_2 values were obtained by the authors. The CO_2 content of normal milk appears to be about 10 % by volume.

It was found possible to remove the CO_2 completely from milk by vacuum exhaustion, provided the milk was spread in a thin layer and agitated.

When milk was pasteurised, the CO_2 content was decreased, but the pH value remained unchanged; but if the CO_2 was completely removed before pasteurisation, the pH value appeared to decrease slightly.

CO_2 exists in milk as carbonic acid ($H_2 CO_3$) and probably as sodium bicarbonate (Na H CO_3); the ratio is about 1 pt. $H_2 CO_3$ and 2 pts $NaHCO_3$. The CO_2 tension of milk is calculated to be about equal to 50 to 55 mm. of mercury, in the case of 0.01 N solution, pH 6.6 at 20°C, that is to say slightly above the CO_2 tension value in blood, which is 47 mm.

1283 - **Determination of Watering and Skimming in the Case of Samples of Altered Milk** (1). — ANDOYER, G., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 15, pp. 588-589. Paris, October 10, 1921.

Samples of milk submitted to experts for inspection are frequently kept too long and in an advanced state of decomposition. The milk has become a coagulum containing fat, insoluble mineral elements and albuminoid substances. This coagulum floats in a serum in which are present mineral salts, lactose and its decomposition products, together with different substances producted by the alteration of the casein.

The author estimated the nitrogen content of the coagulum after the removal of the fats and the subtraction of the mineral elements. From a large number of samples, he repeatedly obtained an average figure of 15.6 %. This percentage of nitrogen is exactly that of the casein; thus instead of estimating the nitrogen, all that is necessary is to determine the weight, after subtracting the butter and salts.

This discovery facilitates the application of KLING and ROY's method of analysing altered milks and allows in addition for the determination of the ash.

The authors named determine the casein by obtaining the nitrogen content of the sample (by KJELDAHL's method), which they disintegrate with sulphuric acid. The mode of operation proposed by the Author is as follows :

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(1) See *R.* 1912, No. 506; *R.* 1914, Nos. 65, and 509; *R.* 1917, No. 371; *R.* 1920, No. 123. (*Ed.*)

The sample, after having been slightly acidified by the addition of acetic acid, is passed though an old filterbed. After several washings with distilled water, aliquot parts of the filtrate are taken and the following determinations made : 1) of the soluble ash (the material being desiccated and incinerated) ; 2) of the albuminoids rendered soluble by the alteration. In order to obtain this second result, the total nitrogen content is found, by the KJELDAHL method and the figure obtained is multiplied by the factor 6.39.

Another portion of the coagulum, after desiccation, is exhausted with ether, in order to separate the fats, weighed after the solvent is removed and then incinerated.

These various operations allow of the determination of the butter, of the portion of the casein that may be regarded as unaffected, and of the insoluble ash. The results, added to those obtained from the filtered serum, give the amount of butter, casein and ash in the milk tested, and make it possible to calculate the degree of watering and skimming.

The author tested the accuracy of this method as compared with that used by KLING and ROY. He obtained very satisfactory results which are given in the following table.

		Fresh milk analysed according to the official method	The same milk (altered) after being kept for 7 months	
			KLING and ROY method	Proposed method
I	Butter . . . in gm. per litre	34.60	34.45	34.40
	Casein . . . » » »	31.10 (per total N)	31.00	31.20
	Ash . . . . . » » »	7.20	?	7.15
II.	Butter	29.10	28.80	28.80
	Casein	26.15	26.35	26.30
	Ash	6.15	?	6.15

1284 - **Determination of the Keeping Quality of Milk.** - I. BAKER, J. C, and VAN SLYKE, L. L., in *New York Agricultural Experiment Station, Geneva, N. Y., Technical Bulletin* No. 72, 8 pp. Geneva, N. Y, June 1919. — II. COOLIDGE, L H, and WYANT, R W., in *Journal of Dairy Science*, Vol. III, No. 2, pp 156-160. Baltimore, 1920.

By the keeping quality of milk is understood the length of time milk remains sweet, and suitable for direct consumption.

Various methods have been proposed for measuring the keeping power of milk : 1) determination of acidity by titration ; 2) estimation of the amount of impurities in suspension ; 3) biochemical tests ; 4) bacteriological examination. Such methods, while useful in determining certain factors relating to the cleanliness and sanitary character of the product, are not satisfactory, at least in the forms used as a means of measuring how long milk will keep. Titration methods are not sufficiently sensitive to changes of reaction. The degree of impurity in the milk is primarily a measure of cleanliness but does not bear any relation to its keeping qualities. Bacteriological examinations have been used chiefly to determine the cleanliness and wholesomeness of milk, but as the authors have found, yield results that are generally of value in measuring the keeping quality especially in relation to acid production. The technical character of a bacteriological examination limits its use to trained workers. A simple method is still needed that can be relied upon to give sufficiently accurate results.

The method proposed by the authors is the brom-cresol purple test (described in *Technical Bulletin*, No. 71, of the New York Agricultural Experiment Station and in the *Journal of Biological Chemistry*, Vol. XL, No. 2, p. 307, 1919) (1) with the following simple modifications: the test-tubes and pipettes are sterilised before use, and the milk in the tubes is incubated for a fixed period at a definite temperature (18° to 20° C). Every 24 hours, the changes in the colour of the milk are noted. The principal factor affecting the keeping quality of milk as measured by this test is the production of acid; other changes can also be noticed such as the coagulation of casein, digestion of casein, formation of alkaline salts, production of gas and the development of abnormal odour or taste.

The changes of colour allow 4 successive stages of acidity to be distinguished: greyish-blue (normal milk); greyish-blue interspersed with yellowish, or greenish-yellow shades (distinct, but weak acidity); greenish to greenish-yellow (marked acidity); pure yellow (great acidity).

A comparison of the results of this test with those obtained by microscopic examination show that the increase in acidity corresponds fairly well with the increase in the number of bacteria present. The other factors affecting the keeping property of milk (digestion of casein, production of gas, of alkalis, abnormal odour or taste), are readily seen, but often do not appear until after 24 hour's incubation.

II. — COOLEDGE and WYANT carried out a long series of experiments in the hope of finding a satisfactory method of determining the sanitary condition of milk, as all which had hitherto been adopted were open to much criticism. They used the colorimetric hydrogen ion determination. The results obtained with the Brom thymol blue indicator proved the method to be a simple and accurate means of measuring the activity of bacteria and enzymes present in the milk. The poor samples of milk can be detected at the end of one hour (the lower the keeping quality of the milk, the sooner the results are obtainable). The best samples give their proper grade at the end of 8 hours. Over 100 samples of milk may be easily examined each day, if the comparator designed by COOLEDGE (*Journal of Industrial and Engineering Chemistry*, 1920), is used. This examination is rendered easier by the use of a table, which at present the authors regard as provisional only. It classifies the milk according to the purposes for which it is suited, the determination been based on the results of the test.

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(1) See also No. 1280 of this *Review*. (*Ed.*)

[1284]

In this table the milks are divided into 17 classes: the 3 first (pH = 5.8 after 1-2-3 hours of incubation) are condemned as useless; the 6 following classes (pH = 5.8 after 4-5-6-7-8 hours of incubation) are milks for skimming and butter-making; the 2 following (pH = 6.0 and pH = 6.1 after 8 hours) are milks suitable for condensing; the 12th class (pH = 6.2 after 8 hours) can be used for cheese-making; the 5 last classes (pH, respectively = 6.3 — 6.4 — 6.5 — 6.6. — 6.7 after 8 hours) consist of milks suitable for the ordinary market.

1285 - **Comparison of Fat Test in Milk as Determined by a Cow-Testing Association and by a Creamery.** — TROY, H. C., in *Cornell University, Agricultural Experiment Station, Bulletin* No. 400, 66 pp, bibliography of 12 works. Ithaca, New York, Jan. 1920.

Of recent years, the practice of selling milk wholesale on a weight and fat-percentage basis has become general throughout the State of New York. The members of cow-testing associations usually compare the fat percentage found by the association tester with the percentage found by the purchaser. Both the tester and purchaser generally determine the fat content by the BABCOCK method, but use a different method for obtaining the test sample and the average fat percentage for each month.

Variations in the fat percentages determined by the two tests frequently occur, as can be seen on comparing the herd record books of cow-testing Associations with the creamery records.

The author compared the milk and fat percentage records of 22 herds as found by a cow-testing association with similar records obtained at the creamery belonging to the College of Agriculture of Cornell University, in the hope that by showing the range and frequency of variations between the results of the two tests, a source of dissatisfaction might be removed.

The records of the testing association showed that when the fat percentage of milk was determined once a month in two successive milkings, it frequently varied more than 0.5 %, and sometimes more than 1 % from the results of the preceding or following monthly test.

The fat percentage variations found in the herd milk by the association tester were similar to those found in the milk of individual cows, but the range of variation in herd milk was narrower.

The average fat percentage in the milk given by a herd at two successive milkings as found by the association tester, ranged usually from 0.2 to 0.3 % above or below the fat percentage for the month as found by the creamery.

In herd milk, differences of over 0.5 % were not uncommon between the monthly fat percentage as found by the association test, and the creamery test respectively.

The differences between the fat percentages found by the two tests were less than 0.1 in 59.375 % of the 32 complete annual records; they were between 0.1 and 0.2 % in 31.25 % of the records, and were greater than 0.2 % in 9.375 % of the records.

When all the milk produced during a year by a herd in a testing association is delivered to a creamery and the average difference between the association test and the creamery test exceed 0.1 % of fat for the year, an effort should be made to determine the cause of the difference.

Some of the milk tested by the association is used on the farms and, if precautions are not taken to have the fat percentage of this milk the same as that of the milk delivered to the creamery, frequent variations in association and the creamery tests may result.

These two tests agree fairly well in recording fat-percentage changes due to an advance in the period of lactation where the record covers a production period of several months, but the daily fluctuations of the fat percentage in herd milk, and the association method of accepting the fat percentage in two successive milkings as the average for the month, do not insure a close agreement between the two tests for monthly periods.

The association practice of testing monthly throughout the year, two successive milkings of each cow in a herd, permit a fair estimate to be made of the fat content of the milk produced by the herd during the year.

1286 - **The Alcohol Test as a Means of Determining the Quality of Milk for Condensed Milk Factories.** — DAHLBERG, A. O., and GARNER, H. S. (U. S. Department of Agriculture, Research Laboratory, Dairy Division), in *United States Department of Agriculture, Bulletin* No. 944, 13 pp. Washington, May 12, 1921.

The urgent necessity for some means of determining the quality of milk received at condensed milk factories and other dairy manufacturing plants has resulted in the continued use of the acid test, even after its defects have become generally recognised.

This test is based on the assumption that a titratable acidity above the normal for fresh milk indicates an increase in acidity due to bacterial action. It is well known however that a certain part of the alkali added to milk is combined with constituents of the milk which are not acids (casein, phosphates), but it has not been generally realised how great a variation in the apparent acidity may be due to this cause. The authors own experience has shown that not infrequently milk that was rejected because of high acidity was fresh milk, in which bacterial action was highly improbable.

The most essential property in milk destined for the condensed milk factory is its capacity of withstanding without coagulation a temperature sufficiently high to insure sterilisation. While acidity is an important factor in determining the coagulating point of concentrated milk, other factors such as the ash composition also play a considerable part.

The alcohol test has been used to a limited extent for determining the quality of milk with special reference to its sanitary condition. The test is practical and easy to make : 1 cc. of milk is added to 1 cc. of alcohol in a small test tube, and mixed. Any sign of coagulation is then noted ; the gradation of the process is shown by the size of the curd particles formed.

By means of a series of experiments carried out at Grove City Creamery and in 2 factories of condensed milk, the authors were able to determine the relative value of the alcohol and acid tests. Their conclusions are as follows:

1) The acid test as ordinarily used will eliminate a portion of the unsatisfactory milks, but on the whole it is unreliable and inadequate as a means of determining the quality of milk for condenseries where evaporated milk is manufactured.

3) There is no direct relation between the coagulation of milk with alcohol and its titratable acidity, but milks high in titratable acidity as a result of fermentation, will in the majority of cases show coagulation with alcohol.

3) The alcohol test is a practical and reliable means of determining the quality of milk for condenseries making evaporated milk. It is believed that it can be used with advantage in a large majority of average condensed-milk factories.

1287 - **The *Sporogenes* Test as an Index of the Contamination of Milk.** — AYERS, H. S., and CLEMMER, P. W., in *U S. Department of Agriculture Bulletin.* No. 910, 20 pp., bibliography of 15 works. Washington, April 25, 1921.

The *sporogenes* test is based on the characteristic milk reaction produced by certain anaerobic spore-forming bacteria which are widely distributed in nature and are particularly common in faecal material. *Bacterium enteritidis sporogenes* Klein; *B. aerogenes capsulatus* Welch (= *B. Welchii* Migula), *B. perfringens* (Veillon and Zuber) and *B. Saccharobutyricus immobilis* (Schattenfroh and Grassberger), are either identical or very closely related species producing in milk under anaerobic conditions what is known as "stormy" fermentation and coagulating the casein in 24 hours at 37° C. This reaction has been used in order to detect the presence of *B. enteritidis sporogenes* (not be to confused with *B. sporogenes* of METCHNIKOFF), which indicates contamination by faecal matter, or at least want of cleanliness in production. This test is called the *sporogenes test*, for it consists in searching for *B. enteritidis sporogenes*. It has the advantage of being equally applicable to fresh and to old milk, and even to milk that has been pasteurised. Should it prove reliable in gauging the cleanliness of production and be relatively accurate, it would be extremely valuable in milk control work. There seems however to be a difference of opinion among investigators as to the value of the *sporogenes* test, some (WEINZIRL and VELDEE) consider there is a distinct connection between the stormy fermentation due to *B. enteritidis sporogenes* and the cleanliness of milk, while according to others, this test has limitations (SAVAGE), is of little value (RITCHIE), or is even useless (BARTHEL). This induced the authors to give the test a thorough trial under controlled conditions,

SAVAGE carried out his trial in the following manner. Small. narrow tubes about 4 inches by ¼ inch were used in series of [illegible]. The tubes were sterilised and 2 cc. of milk were poured into each. The milk was heated to 80° C for 10 minutes, then cooled and incubated under anaerobic conditions at 37° C. After 48 hours, the tubes were examined. each tube which showed stormy reaction was regarded as positive: 0 or 1 positive tube = good milk; 2, 3 or 4 positive tubes = unsatisfactory milk; 5 or more positive tubes = bad milk.

WEINZIRL employed the following method.

From each sample to be examined 5, 10, 15 cc. of milk were taken. The milk was heated at 80° C for 10 minutes and melted paraffin poured on to it so as to make a layer $^1/_8$ inch or more in thickness. The tubes were then cooled and incubated at 37° C.

From his examination of cow manure, WEINZIRL calculated that there were probably 10 000 *sporogenes* per gram of manure in the partially dried condition in which it usually enters milk. A positive reaction in the 5 cc. tube indicates 1 gm. of manure in 50 litres of milk; a positive reaction in the 10 cc. tube indicates 1 gm. of manure in 100 litres of milk, and a positive reaction in the 15 cc. tube indicates 1 gm. of manure in 150 litres of milk.

The authors conclude from the results of their experiments that SAVAGE's method is not sufficiently delicate to be of great value, not enough milk being used in each tube.

WEINZIRL's method does not appear to show the quantity of cow manure in the milk. This seems to be due to the variation in the number of *B. enteritidis sporogenes* spores in the manure.

The authors' experiments indicate that the majority of the *B. enteritidis sporogenes* spores gain entrance to the milk by means of cow manure. Dirty utensils do not, as a rule, introduce the spores of this microorganism into the milk. With 10 tubes and 20 cc. of milk in each tube, the *sporogenes* test carried out according to SAVAGE's method shows a fairly definite relation to conditions of production. This relation is more definite than was shown either by the SAVAGE, or the WEINZIRL test.

None of the tests, however, showed a definite correlation between the number of positive tubes and the quantity of manure in any given sample. But with 20 cc. doses of milk and discounting individual variation (*i. e.*, the variation in the results of each test), there is a general trend of agreement between the results of the test and the amount of manure in the milk. As a rule, the *sporogenes* test with 10 tubes and 20 cc. of milk shows a large number of positive tubes when the milk is produced under dirty conditions; if the conditions are clean, the test is apt to be negative, or to show only a few positive reactions. This test therefore tends to differentiate between extremes in method of production, and naturally most milk will fall within these limits. The nearer the conditions of production approach one extreme or the other, the more accurately will the *sporogenes* test indicate the conditions. No reliance can be placed in one test with one sample. In the case of each milk examined it is necessary, in order to eliminate individual variations, to make a series of tests and on a number of samples. When the limitations of the tests are understood and the results properly interpreted, its use should furnish considerable information as to cleanliness of production, but the results ought to be verified by an actual inspection at the farm.

[1287]

1288 – **A Pseudolactic Ferment of Frequent Occurrence in Milk "Glaireous Lactic Streptococcus."** — VIOLLE H., in *Annales de l'Institut Pasteur*, Vol. XXXV, No. 3, pp. 216-229, figs. 2. Paris, 1921.

There is often present in milk and its derivatives a microrganism described by the author under the name of "glaireous lactic streptococcus". It probably exists in all dairies, being introduced by water, soil and food substances. Its development is extraordinarily increased by adding nitrites to the culture medium.

This bacterium is a streptococcoid in shape; its cultures on gelatine have the appearance of broad glassy streaks. It forms lactic acid with most sugars and also assumes a viscous gelatinous aspect in sugar media.

The fact that this streptococcus is not pathogenetic, together with the appearance of its cultures, and some of its biological characters distinguish it completely from the forms inducing disease in man and cattle, streptococcus pyogenes, and the streptoccus of contagious mammitis respectively.

It also differs in certain respects from the lactic streptococci, and should therefore be classed among paralactic or pseudolactic bacteria.

1289 – **Causes and the Preventive Treatment of "Buttons" in Sweetened Condensed Milk.** — ROGERS, L. A., DAHLBERG, A. O., and EVANS, A. C., in *The Journal of Dairy Science*, Vol. III, No. 2, pp. 122-129, 2 tables separate from the text. Baltimore, March 1920.

The authors give the results of observations made at the Laboratory of the Dairy Division of the United States Department of Agriculture on the subject of the hard, brownish-red masses of coagulum found in sweetened condensed milk and known in commerce by the name of "buttons".

They are usually the result of enzymes produced by *Aspergillus repens*, but may also be caused by other moulds. It is probable that the milk becomes contaminated after leaving the condenser.

An effective method of preventing the formation of "buttons" is to seal up the tins under a low pressure (508 mm.), for moulds develop only when they have a good supply of oxygen at their disposal.

1290 – **"Mottles" in Butter, Their Causes ans Prevention.** — HUNZIKER, O. G., and HOSMAN, D. F. *Journal of Dairy Science*, Vol. III, No. 2, pp. 77-106, figs. 19. Baltimore, March 1920.

Butter instead of being of a uniform colour, is sometimes traversed by waves or streaks of different shades, or covered with patches. In the latter case, when deep-yellow translucent blotches interspersed with whitish opaque spots make their appearance, the butter is said to be "mottled".

Although mottles in butter have no effect upon its flavour, keeping quality and wholesomeness, they greatly depreciate its market value.

The authors give a summary of the previous investigations made for the purpose of discovering the causes of this defect, and afterwards describe their own experiments which consisted in: churning at different rates, stopping churning in all cases when the granules of butter had attained the size of wheat grains; washing or not washing the butter; salting it or not salting it; examining under the microscope the product obtained.

It was found that mottles appear in salted butter in which the working had been incomplete or lacking in uniformity. In mottled butter, the deep-yellow patches contain relatively few and rather larger water droplets, while the white patches contain large numbers of very minute droplets. The authors conclude that salt disturbs the emulsion of water-in-fat in butter, and that the uniformity of the emulsion can be restored by the proper working of the butter.

In order to prevent mottling, butter must be worked sufficiently to accomplish the fusion and re-emulsification of the water and brine. This point is usually reached when the butter has been reduced by working into a thick plastic and tough consistency. The working must be uniform throughout the churning; therefore sufficient workers should be employed to deal with the amount of butter to be made.

1291 – **Casein Industry and Production in Denmark.** — *Journal de la Société Nationale des Agriculteurs de Belgique*, Year III, No. 10, pp. 315-316 Brussels, Oct. 1921

The casein industry in Denmark came into being during the winter of 1909 and the spring of 1910. At that time, the condition of the Argentine market had caused a great rise in the price of casein, and the price of Danish cheeses was so low, that the dairies in Denmark suffered heavy loss. The industrial manufacture of casein seemed to offer an excellent solution of the problem arising out of this crisis, as by this means, the large superfluous quantities of skim milk thrown on the market by the collapse of the local cheese trade could be turned to good account.

Owing to the various ways in which casein is used, the product found a ready sale in many directions and for a certain time its price rose. The importance of the industry grew rapidly and before the War, the output exceeded 2 million kg. The manufacturing process is methodical and scientific.

The quality of the casein is good, but is still somewhat inferior to the French product (1) which is considered the best in the world, the Danish manufacturers however have every hope of attaining this standard of excellence. It is thought, that the casein industry will regulate the price of Danish cheese on the market. As no local cheeses are exported if the prices are low, more casein is then made and the price of cheese is raised and *viceversa*. The work is distributed as follows: the dairies ("Mejerier") make the great mass of curd ("Ostemasse") and the casein is obtained from the "Ostemasse" at the drying-houses ("Torrerier"). Some dairies, however have their own drying plant.

In Denmark, several methods are used in the drying process.

1) Skabsystemet," or closed cupboard method;

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(1) See *R* Dec [illegible] No [illegible] (*Ed.*)

2) " Kanalsystemet, " or conduit method (adopted in France) ;

3) " Forestner par Bakken Systemet, " in which small desiccators on troughs are employed.

There are now 15 casein factories of which the chief are at Rudjobing, Kjerteminde, Aarhus, Jylland, Logstor and Hjorring.

Nearly all the casein made in Denmark is exported, most of it going to Hamburg, New York and Boston, either by way of Copenhagen or Aarhus.

Danish and Swedish casein is " Maelkesyre Kasein, " or lactic acid casein (1) a much prized article of commerce outside Denmark, being used in the manufacture of paper, gelatine, and galalith, and also as an article of food. There is, however, some idea of starting a factory in Jutland for the industrial treatment of casein.

Casein is sold by sample, in sacks containing 50, 75 or 100 kg.

1292 - The Separation of Sound Beans From those Attacked by Bean Weevi (*Acanthoscelides obtectus*).

— BROCQ ROUSSEU (Directeur du Laboratoire militaire de recherches vétérinaires), in *Bulletin de la Société scientifique d'Hygiène alimentaire et d'alimentation rationnelle de l'Homme*, Vol. IX, No. 5, pp. 332-335. Paris, 1921.

The number of weevil-infected seeds in a collection of beans may be very variable ; the author found the percentage of diseased seed varied from 1 to 67 in the samples he examined.

When the proportion of infected seeds is low, they can be easily sorted, and little trouble is occasioned.

Where however it is high, the infected beans are almost useless, on account of the large number of larvae and adult insects contained.

In such cases, it would be advantageous to have some practical means of separating the sound from the diseased beans. This could be done by employing liquids of such density as will allow the separation to take place automatically, the infected beans rising to the surface, and the sound sinking to the bottom of the vessel. Since however, solutions of very high specific gravity are required and the necessary density may vary with each species of bean, the problem is not always easy to solve.

For a lot of white beans belonging to the variety known as " prolifique nain sans parchemin " (prolific dwarf sugar beans), of which 67 % contained weevils, the author had to use a 50 % solution of nitrate of sodium, with a density of 1.418. The healthy beans can be washed immediately, in order to remove the nitrate of sodium, and are fit for eating. If this treatment were carried out on a large scale, it is easy to imagine the series of receptacles necessary for effecting the separation. The only trouble in this case would be the cost of the sodium nitrate.

Other varieties of lower specific gravity are more easy to treat as regards the question of solvent.

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(1) See *R* July-Aug. 1920, No. 801. (*Ed.*)

The author investigated 3 lots of red beans, attacked in the proportions of 1 %, 6 % and 20 %. For these he used a 25 % solution of sea salt (spec. grav. 1.26). Separation took place automatically as before.

It is thus necessary, in the case of each variety of bean, to discover the solution required to bring about the separation of the sound seeds. The author is of opinion that nearly all varieties could be treated with solutions varying within the limits he has mentioned; often a solution of sea-salt will suffice.

In this way infected beans can be eliminated easily and at small cost, and without danger to their food value.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

1293 - **Behaviour of Certain Cereals Towards Rust in Algeria. — See No. 1212 of this *Review*.**

1294 - ***Phalaris bulbosa*, Forage Grass Resistant to Disease, in Argentina. — See No. 1215 of this *Review*.**

1295 - ***Helminthosporium gramineum*, a Hyphomycete Injurious to Wheat in Emilia, Italy** (1). - BASSI F., in *L'Italia Agricola*, Year LVIII, No. 10, pp. 298-301, figs. 2, Piacenza, October 15, 1921.

Wheat in the district of Plaisance was found on the eve of harvest to be suffering from a widespread and very serious attck of *Helminthosporium gramineum* (Rabh.) Erikss., a parasite which had hitherto been regarded as of limited occurence in Italy. It had been observed formerly on crops of seed wheat, but these were only sporadically infected. It usually attacked barley, and was even considered to be a parasite of barley rather than one proper to wheat.

The field infected in 1921 had a superficial area of 10 hectares; it had been sown with the wheat "semi duro del Fucino," following broken up permanent pasture. Although greatly reduced by lodging, the crop would have been fairly good, but for the fungus, which completely destroyed it.

A careful examination of the wheat culms and ears attacked by *H. gramineum* revealed the discoloured and stunted appearance characteristic of diseased plants. Ears though apparently normal, were either empty, or else contained a large proportion of badly nourished, and hence atrophied, caryopses, while the culms broke at the first node, if gently pulled.

The author, basing his remarks on the results of experiments carried out in the United States, gives concise information on the symptoms and course of the disease and the methods of its control.

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(1) See also *R.* Nov. 1912, No. 1573; *R.* April 1913, No. 347; *R.* April 1914, No. 388; *R.* Jan. 1917, No. 100; *R.* August 1917, No. 777; *R.* Dec. 1916, No. 1426; *R.* Feb. 1921, No. 144. *(Ed.)*

1296 - Control of "Damping Off" and " Food Rot" of Tomatoes, Caused by *Phtyophhtora parasitica, Phyt. cryptogea* and *Rhizoctonia Solani* in England. — BEWLEY, W. F., in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 7, pp 653-654. London, Oct. 1921.

Sterilisation of the soil, seedboxes and pots by means of heat or formaldehyde have previously been proposed as adequate methods for control of the serious disease of tomatoes, known in England as " damping off " and " foot root ", caused by *Phytophthora parasitica* Dastur (1), *Phyt. cryptogea* Pethybridge (2) and *Rhizoctonia Solani* Kühn (3). These methods, however, do not suit many growers and as a result, another remedy has been put forward, which has been named " Cheshunt compound ", investigations relative to this compound having been made at the Experimental and Research Station, Cheshunt.

This compound contains 2 oz. of copper sulphate, and 11 oz. of ammonium carbonate, reduced to fine powder and thoroughly mixed. The mixture may be stored in the dry state in an airtight receptacle, without which it gradually loses ammonia and becomes less potent.

The dry mixture should be stored for 24 hours in a tightly corked glass or stone jar before using. The solution is then prepared by dissolving 1 oz. of the dry mixture in a little hot water and making up to 2 gallons with water.

The solution must not be put into vessels of iron, tin or zinc, as it would corrode them and lose its strength. Only just as much as is required for immediate use should be prepared.

Plants already attacked receive no benefit from the solution and eventually die, unless the healthy tops are cut off above the diseased part and treated as cuttings. It is possible however to kill the causal organisms by watering infected soil with the solution, after which immediate planting may follow without harming the plants. It is possible also to treat infected soil with plants *in situ*. The solution destroys the disease organisms and at the same time increases the vigour of the plant.

When the soil is suspected of being infected, the following methods should be adopted :

a) *Seed-boxes*: the soil should be thoroughly watered with the solution after sowing and covering the seeds. Generally 1 pint per box (14 × 9 × 2 in.) is sufficient.

b) *Pots*: the young seedlings should be planted and watered with the solution immediately afterwards. To enable each plant to receive sufficient solution, the level of the soil should be 1 inch. below the level of the pot. If left overnight before treatment, many plants become infected and the treatment is rendered useless.

c) *Houses*: each plant should be removed when attacked, the hole watered with 1 pint of solution, a healthy plant inserted and watering with the solution should be repeated.

(1) See *R.* Sept. 1913, No. 1106. *(Ed.)*
(2) See *R.* Apr. 1919, No. 537. *(Ed.)*
(3) See *R.* Sept. 1913, No. 1105 ; *R.* Jan. 1916, No. 123 ; *R.* Jan. 1921, No. 107. *(Ed.)*

This solution has a beneficial effect in the case of many seedlings besides the tomato, also attacked by "damping off". In the case of very delicate seedlings however it is necessary for the solution to be more diluted. Preliminary experiments with the compound upon other root diseases have also given satisfactory results.

1297 - **Studies on *Pseudomonas Pruni*, a Bacterial Disease of Plum, Peach and other Rosaceae in Japan.** — KUWATSUKA, K., in *Annals of the Phytopathological Society of Japan*, Vol. I, No. 4, pp. 12-19. Nishigahara, Tokio, July 1921.

The study of *Pseudomonas Pruni*, E. F. Smith has chiefly been made in the United States and has also been described in Japan as the cause of black spot of the plum or bacterial disease of stone fruits. The author reported in 1919, a serious outbreak of this disease on the peach in Shizuoka; since then inoculation experiments have been made on the plum and peach, on many other species of the genus *Prunus* and on several Rosaceae. Observations were also made on the influence of soil moisture upon the infection of the causal organism.

A number of strains of *Ps. Pruni* were isolated, leaves, branches, and fruits of diseased peach and plum trees being taken, and their virulence was proved by many inoculation experiments on normal leaves or fruits. It has been proved that these species cause not only the shot-hole disease on the leaf, but also the black spot on the plums. The results of inoculation experiments with plums (variety Terada) has led to the supposition that the causal organism hibernates through the winter in the infected tissue of the twigs under field conditions, and if it is not destroyed, it serves in the spring as a central source of infection.

As regards the susceptibility of Rosaceae to *Ps. Pruni*, the results of inoculation experiments indicate that almost all species of the genus *Prunus*, both cultivated and wild, and also *Sorbus japonica* are subject to attack. The following plants have recently been noted as liable to infection: *P. Buergeriana*, *P. crassipes*, *P. donarium* sub. sp. *elegans* var. *glabra*, *P. Itosakura*, *P. japonica*, *P. Mume*, *P. Mume* var. *microcarpa*, *P. Mume* var. *Bungo*, *P. triflora* and *S. japonica*.

When the inoculations are made on the stems of the genus *Prunus*, there is generally a formation of some canker-like or sunken parts, while on *Sorbus japonica* small galls develop at the point of inoculation.

An inoculation experiment made in a green house with Early Rivers two year old peach trees, has demonstrated that soil moisture plays an important part with respect to *Ps. Pruni* infection. Apparently the influence is more accentuated than that associated with atmospheric moisture. It is therefore probably advisable in orchards, having high level of underground water, to attend carefully to the drainage, which is an important point in the prevention of this disease.

1298 - **Diseases and Pests of the Vine, in Peru.** — See No. 230 of this *Review*.

1299 - *Phylaspora baccae*, Ascomycete Injurious to the Vine in Japan. —

NISHIKADO, Y., in *Annals of the Phytopathological Society of Japan*, Vol. 1, No. 4, pp. 20-42, pl. 1. Nishigahara, Tokyo, July 1921.

Report of studies on a disease of grapes made in Japan 1911 to 1916. This disease has been prevalent for the last 10 years in Okayama prefecture and in a few other places where the vine is cultivated.

The peduncle, pedicel and berries of *Vitis vinifera* are infected, but the leaf and stem remain immune. The disease is known locally under the names of " Fusagare " (cluster rot) or Zikugare " (peduncle rot).

The pycnidial stage of the causal fungus is identical with *Macrophoma reniformis* (Viala and Rav.) Cav., the recognised cause of black rot in the Caucasus. The perithecial stage is identical with *Guignardia baccae* (Cav.) Jaczewski (the perithecial stage of *Macr. reniformis*), except for the fact that the paraphyses exist among the asci in the case of the fungus in question in Japan.

This last-mentioned fungus does not belong to the genus *Guignardia*, but to *Physalospora*, because the existence of the paraphyses in the perithecia cannot be denied. Therefore the name *Phys. baccae* Cav. (changed by JACZEWSKI to the name *Guign. baccae*) is adopted in this report.

The fungus develops very rapidly on such cultural media as boiled potato or boiled rice, giving rise to many black aerial mycelia, and occasionally even producing pycnidia. The pycnidia are not similar in their outer appearance to those found on the host. With regard to the pycnospores however the author has found no great difference between them.

The parasitism of this fungus has been fully demonstrated by previous investigations. However, the inoculation experiments conducted by the author have not up to the present led to any conclusion.

1300 - Diseases of the Douglas Fir (*Pseudotsuga Douglasii*) in Scotland. -

WILSON, M., in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXXV; Pt. 1, pp. 77-78. Edinburgh, Sept. 1921.

Since the recent publication of the paper on *Phomopsis Pseudotsugae* (1) observed on *Pseudotsuga Douglasii*, the author's attention has been drawn to a parasite, notified twice previously in Scotland, in Ayrshire, (1896-1898) and Aberdeenshire (1911). Although identified as *Phoma pithya* Sacc. this parasite of the fir, being given the symptoms associated with its appearance, corresponds most probably in the author's opinion to *Phom. Pseudotsugae*. It may therefore be concluded that *Phom. Pseudotsugae* has been in existence in Scotland for a considerable number of years. Judging from the small number of records, however, it appears that at first the disease was not widespread. In fact it is only within the last ten or twelve years that its occurrence in various localities has been notified. There is little doubt that the actual damage done by the parasite has increased recently and that this cannot be altogether due to the increased area now under *Ps. Douglasii.* This view has received confirmation by the discovery of *Phom. Pseudotsugae* in various localities in England (1).

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(1) See *R.* Jan. 1921, No. 110. (*Ed.*)

Botrytis Douglasii (2) recorded several years ago in Scotland on *Ps. Douglasii* is widespread. This disease is also described as common in England.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1301 – **A Forest Insectarium in Spain.** — *Revista de Montes*, Year XLV, No 1065, p. 166-167. Madrid, November 1, 1921.

One of the duties devolving upon the " Comisión de la Fauna Forestal Española " was the institution of an Insectarium for the purpose of experimental researches having as their principal object the study of the parasites attacking the insects most injurious to forest trees.

This Insectarium, which was recently opened, has been working from the beginning in a forest at Torrelodones, and has already obtained good results.

It is about to be transferred by permission of the King, to " Plantío de Infantes ", on the estate of the " Real Casa de Campo y Bosque del Pardo ", where the conditions for research work are excellent. The great forest surrounding the " Plantío ", and also the vicinity of the Court, are both circumstances tending to facilitate the teaching and cultural work of the Insectarium.

1302 – **Insects Injurious to Cultivated Crops in the Philippines** (3). — WOODWORTH, H. E., in *The Philippine Agriculturist*, Vol. X. No. 1, pp. 9-35. Los Baños, Laguna, Aug. 1921.

Systematic enumeration in alphabetic order and with botanical name of plant host, of insects injurious to cultivated crops in the Philippines, including all the authentic and definite records, published and otherwise, up to the present time

The scientific names of the plants are accompanied by their popular names whenever possible.

Many of the insects enumerated are recorded for the first time as injurious to the crops in the Philippines. By far the larger part of the host plant records are new in this island

The author does not claim to have made a complete list; his intention has been simply to furnish a basis for further records, which should undoubtedly be quickly increased.

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(1) See *R.* Mar. 1921, No. 345. (*Ed.*)

(2) See *R.* Mar. 1921, No. 346. (*Ed.*)

(3) See also *R.* June 1912, Nos. 917 and, 992; *R.* Jan. 1913, No. [illegible]; *R.* May 1913, No. 450; *R.* June 1913, No. 764; *R.* Dec. 1916, No. 1348; *R.* July 1915, No. 695; *R.* Dec. 1917, No. 1253; *R.* Jan. 1918, No. 53; *R.* Aug. 1918, Nos. 864, 933 and 936; *R.* Sept. 1918, No. 1000; *R.* Feb. 1919, No. 268; *R.* Mar. 1919, No. 397; *R.* Jan. 1921; No. 117; *R.* June, 1921 No. 695; *R.* July 1921, No. 722. (*Ed.*)

1303 – **Method of Control of Cotton Stem Weevil, and Bollworm Recommended in Cambodia.** — See No. 1221 of this *Review*.

1304 – **Control of Cotton Parasites in State of São Paulo, Brazil.** — See No 1220 of this *Review*.

1305 – **The Pink Bollworm of the Cotton Plant *(Platyedra [Pectinophora] gossypiella)* Recorded for the First Time in Porto Rico** (1). – LEGRAND, J. F., in *Revista de Agricultura de Puerto Rico*, Vol. VII, No. 3, pp. 9-13. San Juan P. R., September 30, 1921.

Platyedra (*Pectinophora*) *gossypiella* has been found in the island of Porto Rico, in the district of Humacao on a plant of cotton " Caravonica. "

Further researches have revealed the presence of this dreaded micro-lepidopteron in the neighbourhood of Arecibo, Hatillo, Camuy, Quebradillas and Isabela.

The " Departamento de Agricultura y Trabajo at once took all the measures in its power for the control of the pest.

The author gives information as to the geographical distribution of this insect, its life-history and the means adopted for combating it.

1306 – **Insects Injurious to the Cotton Plant, in Brazil.** — DE FREITAS MACHADO, L., in *Lavoura e Criação*, year VI, No. 8, p. 189. Rio de Janeiro, August 1921.

The following are the insects that have up to the present been recorded as injurious to the cotton plant in Brazil.

Lepidoptera: *Platyedra gossypiella*, popularly known as " lagarta rosea ", *Alabama argillacea* (" curuquerê ") ; *Utetheisa ornatrix* ; *Ut. bella* ; *Exphestia cautella* ;

Coleoptera: *Colaspis* sp. ; *Spermophagus hoffmannseggi* ; *Gasterocercodes gossypii* (" bróca ") ;

Rhyncotes: *Dysdercus ruficollis* ; *Plociomera* (?) sp., *Oncopeltus* sp. ; *Gorgophia* (?) ; *Aphis gossypii* ; *Saissetia depressa* ; *Hemichionaspis minor*.

Gast. gossypii attacks the plant in the region of the collar ; *Saiss. depressa* and *H. minor* injure the stem ; *Alab. argillacea*, *Ut. ornatrix*, *Ut. bella*, *Colaspis* sp. and *A. gossypii* injure the leaves ; *Ph. gossypiella*, *D. ruficollis*, *Plociomera* sp., *Oncopeltus* sp. and *Gorgophia* sp. attack the bolls ; *E. cautella* and *Sperm. hoffmannseggi* destroy the seeds.

1307 – **Insects Injurious to the Coco Palm in Porto Rico** (2). CATONI L. A., in *Revista de Agricultura de Puerto Rico*, Vol. VII, No. 3, pp. 21-25. San Juan P. R., September 30, 1921.

The coco-palm in Porto Rico is attacked by :

1) *Aspidiotus destructor* (" queresa destructiva ") ; this insect lives on the adult leaves and is controlled by cutting and burning all the

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(1) See also *R.* May 1921, No. [illegible]87 ; *R.* June 1921, No. 671 ; *R.* Aug. 1921, No. 870 ; *R.* Nov. 1921 No. 1160. (*Ed.*)

(2) See also *R.* June 1917 ; No. 607 ; *R.* July Aug. 1920, No. 834 ; *R.* Sept. 1921, No. 912. (*Ed*)

leaves attacked, if possible, or else by spraying with an emulsion of petroleum and soap;

2) *Vinsonia stellifera* ("queresa a forma de estrella"); found on the leaves; the same methods of control are applied as in the case of the preceding species;

3) *Pseudococcus nipae* ("chinche harinosa"'); on the leaves; spraying with a very dense emulsion of oil and paraffin, or else of soap and petroleum;

4) *Aleurodicus cocois* ("mosca blanca del coco") is found on the leaves. Remedies, spraying with whale-oil soap in the case of young palms, if the trees are older, the infected leaves should be burnt;

5) *Eutermes morio* ("comején »); this insect makes its nest at the base of the palm leaves, excavating galleries along the petiole; it feeds on the fibrous tissues of the tree. It can be controlled by destroying its nests, or using poisoned baits consisting of a mixture of arsenic and sugar, or a sebaceous mixture with ten parts of sugar and one of Paris green; these baits are placed at different points in the galleries;

6) *Strategus quadrifoveatus* ("caculo rinoceronte del coco"); in the larval condition this parasite destroys the internal tissues of the coco-palm. The best means of controlling the adult insect is to destroy all its possible refuges; light-traps can also be used. Above the light, a small vessel containing a tar-solution is placed into which the insects attracted by the light readily fall. Poisoned baits are useful in destroying the larvae, which are sometimes pursued and caught by birds.

7) *Phyllophaga portoricensis* ("caculo común, or gusano blanco"); this insect destroys the tissues of the palm, it can be combated in the same manner as the last named;

8) *Metamasius hemipterus* ("gorgojo barreno del tallo"); the larvae live on the fibrous tissue of the stem. The palms attacked must be completely burnt. Light traps are efficacious against the adult insects and the larvae are destroyed by their natural enemies.

9) *Platypus* sp. "perforador de la palma de coco"; an insect making holes in the trunk. Light-traps are useful for catching the adults; and the trunk can also be smeared with a poisonous mixture. Trees badly attacked should be destroyed.

1308 - ***Phthorimaea (Ita) ocellatella*, a Microlepidopteron Injurious to Beetroots in Germany** (1). WILKE S., in *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, Year I, No. 5, pp. 33-34. Berlin, November 1, 1921

In September 1921, the caterpillars of *Phthorimaea* (*Lita*) *ocellatella* Boyd. were so numerous in the neighbourhood of Gross-Gerau (Hesse), that entire fields of beetroots were invaded by them, and the growth of the plants seriously menaced. The larvae attacked and destroyed the central leaves and the region of the root-collar.

This microlepidopteron was recorded for the first time in Germany in 1866, when it was found near Wiesbaden.

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(1) See also *R.* Nov. 1918, No. 1315 and *R.* March 1920, No. 600 (*Ed*).

The author gives information regarding the life-history and geographical distribution of the insect, and describes the measures taken for its control.

1309 - *Gyropsylla ilicola* n. gen. and n. sp., Rhynchote Attacking Mate (*Ilex paraguariensis*) in the Republic of Argentina. BRETHES J., in *Universidad Nacional de La Plata, Revista de la Facultad de Agronomia*, Vol. XIV, No. 2, pp. 62-80, figs. 6. La Plata, 1921.

A morpho-biological description of a new representative of the family *Psyllidae* (*Gyropsylla ilicicola*, n. gen. and n. sp.), discovered by the author, who obtained his data from material sent from Concepción de la Sierra de Misiones, where the parasite causes a deformation of the leaves on the maté (*Ilex paraguariensis*), which had been noticed already for several years in Argentina.

This rhynchote spoils the maté crop by producing atrophy of the leaves. As a result of its action, the two halves of the blade fold together lengthwise, bending over more or less at the same time, and finally adhering and forming a kind of bag of varying dimensions, harbouring a colony of the insects. Several pouches can be made on the same leaf, or one may be formed on a small portion of the blade, the rest of the surface remaining more or less normal.

The insect cannot be controlled during the larval stage, for it lives enclosed within these leaf pouches, where insecticides can only penetrate with difficulty, if at all. It is of little use to combat the adult rhynchotes, for when they attain their final stage of development, they may be found on other plants besides the maté. The most propitious moment for their destruction appears to be as soon as the larvae hatch out, and before they have had time to ensconce themselves in the leaf pouches.

Of the various insecticides, a 2 % solution of tobacco extract might be selected for trial. The best time for spraying is, in the author's opinion, about October, when the new shoots are from 5 to 8 cm. long. The proportion of extract to be used and the date of treatment must be determined by the farmers themselves. Should rain fall after the insecticide has been applied, it would of course be necessary to repeat the dose.

1310 - The Cabbage Seed Stalk Weevil (*Ceutorrhynchus quadridens*) in Long Island, New York State (1). — VOGEL, I. H., in *The Canadian Entomologist*, Vol. LIII, No. 8, pp. 169-171. Guelph, Aug. 1921.

Ceuthorrhynchus quadridens Panz. the European insect reported in the United States for the first time by SLINGERLAND (1894) as infesting cabbage seed stalks on Long Island, was in 1920 the subject of special study made by the author in the cabbage fields in the vicinity of Mattituck in the same island. The life history of the insect was observed from the egg to the adult stage.

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(1) See *R.* Nov. 1917, No. 1084. (*Ed.*)

In general, the cabbage seed growers on Long Island have either failed to recognise this insect or confused it with the larval stage of the cabbage maggot (*Phorbia brassicae* Bouché) It is due to this confusion that little information has been secured concerning its distribution and destructive activities in the past

The distribution of this weevil in the cabbage seed fields in the vicinity of Mattituck seemed quite general in 1920.

The losses to the grower may be attributed to the fact that the larvae of *C quadridens* burrow in the pith of the main stalks and branches, and the plant is thus weakened and liable to rupture at the point attacked, and consequently to premature death.

In order to ascertain to what extent the weevil occurs and to determine the extent of loss caused, records were taken in five fields It was found that 47 % of the plants were attacked. At harvest time, 100 normal plants and 100 plants attacked were threshed in order to secure the seed. The amounts obtained are shown as follows

	Weight of seed before cleansing	Weight of seed after cleansing	% of seed lost in cleansing
100 normal plants . . .	109.2 oz	97.4 oz	11
100 attacked plants .	74.3 »	64.8 »	13
loss due to insect		32.6 »	

Plants not attacked yielded therefore about 33.5 % more seed than the attacked plants. If [illegible] of the plants were attacked, the loss would be 16 % of the crop.

The seed yield was approximately 250 lb. per acre, in 1920, and consequently the loss occasioned by the weevil was 40 lb per acre, valued at 50 dollars. Even greater losses have doubtless occurred seeing that a cabbage seed contractor and some growers have reported cases where in previous years this insect has been the cause of the loss of entire crops.

[1310]

ALFREDO RUGGERI, *gerente responsabile*